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No. 85, 42 pages, 15 figures, 3 tables.

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By

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By

Robert O. Schuster[1]

and

Michel M. J. Lavoipierre[2]

INTRODUCTION

In 1926 G. Lombardini established the genus *Heterocheylus* with *H. fusiformis* as the type species. This species was found on an unidentified passalid beetle from Brazil. Unfortunately, more than one species of heterocheylid occurs in Brazil, and we have been unable to identify *H. fusiformis* from the description or from the illustrations. One of us (Lavoipierre) has attempted without success to correspond with Lombardini in an effort to locate the type specimen.

I. Trågärdh, in 1950, described a second species, *H. lomani*, taken from *"Passalus"* collected at Unkimbungu, Belgian Congo. In the same paper Trågärdh proposed subfamily status for mites of the genus *Heterocheylus*. *Heterocheylus lomani* was supposedly described from the male, but the "claviform sensillae" were mentioned in the text and the ventral aspect that was figured shows typical female characters. The species cannot be identified as any of those we presently have, although Trågärdh's illustrations somewhat resemble a species occurring in Madagascar but of unlikely occurrence in Africa. The host *"Passalus"* offers no clue to the identity of *H. lomani* as it is a New World genus of passalid beetle. Tuxen in personal communication (Schuster) indicated that the type specimen is probably lost.

The only described species of *Heterocheylus* that we can identify presently is *H. lombardinii* Womersley. This is a distinctive species well characterized in the original description, and specimens we have taken from passalid beetles of the genus *Mastochilus* agree with Womersley's description.

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Approximately 7,000 passalid beetles in the collections of the California Academy of Sciences, San Francisco, and the Department of Entomology at the University of California, Davis, were examined for heterocheylid mites. The large identified collection of the Academy provided valuable information on aspects of host specificity and of geographic distribution. A total of 1,050 mites was accumulated for this study. Examples of most of the heterocheylid species are deposited with both institutions. The holotype specimens are deposited at the Academy, except for *H. laui* and *H. becki* which are at Davis.

BIOLOGY

No published observations on the biology of these mites are known to us. A parasitic relationship with the passalid beetles has been inferred from the type of mouthparts (Trågärdh). Adult females constituted the majority of specimens recovered. These were seldom gravid, and when gravid, only a single egg was present. These mites, therefore, are presumed to have a considerable longevity and to maintain small stable populations.

HOST SPECIFICITY

The passalid section of *Coleoptorum Catalogus* lists 8 subfamilies, 53 genera, and 481 species. We have examined identified passalids of 8 subfamilies (100%), 39 genera (74%), and 150 species (31%). Heterocheylids were not recovered from all of the passalid species. Also, single species of heterocheylids have been found associated with more than one passalid species, especially in the large genera *Popilius* and *Passalus* which together contain about 150 species. Some genera of passalids, for example those in the subfamily Proculinae, appear to have associated mites of the family Diarthrophalidae to the exclusion of Heterocheylidae. A list of the species examined, and the mites recovered, constitutes table 1. Allowing for the possibility of a few incorrectly identified beetles, or mites, a good correlation is apparent at least at the generic level.

TABLE 1

List of identified Passalidae in the collection of the California Academy of Sciences and associated Heterocheylidae.

Passalid species	Heterocheylid species
AULACOCYCLINAE	
Ceracupes fronticornis Westwood	
Ceracupes arrowi Heller	
Cylindrocaulus patalis Lewis	
Aulacocyclus rosenbergi Kaup	*Heterocheylus incohatus*
Aulacocyclus perlatus Kaup	
Aulacocyclus tricuspis Kaup	

Passalid species	Heterocheylid species
Aulacocyclus papuanus Heller	*Heterocheylus incohatus*
Aulacocyclus errans Blackburn	*Heterocheylus incohatus*
Aulacocyclus edentulus MacLeay	
Aulacocyclus deyrollei Kaup	
Aulacocyclus aliicornis Kuwert	
Taeniocerus platypus Kaup	
Taeniocerus pygmaeus Kaup	
Comacupes basalis Smith	
PSEUDACANTHINAE	
Popilius striatopunctatus Percheron	*Heterocheylus proximus*
Popilius tau Kaup	*Heterocheylus proximus*
Popilius tenuis Kuwert	
Popilius tropicus Percheron	*Heterocheylus proximus*
Popilius disjunctus Kuwert	*Heterocheylus proximus*
Popilius lenzi Kuwert	
Popilius frantzi Kuwert	
Popilius amazonicus Gravely	
Oileus rimator Truqui	
Oileus sargi Kaup	
Undulifer incisus Truqui	
PROCULINAE	
Proculus goryi Melly	
Publius crassus Smith	
Verres hageni Kaup	
Verres furcilabris Eschscholtz	
Verres cavifrons Kuwert	
Veturius tuberculifrons Kuwert	
Veturius transversus Dalman	
Veturius cephalotes St. Fargeau & Serville	
Veturius platyrhinus Westwood	
Veturius cirratus Bates	
PASSALINAE	
Passalus unicornis St. Fargeau & Serville	
Passalus interruptus Linnaeus	
Passalus coniferus Eschscholtz	*Heterocheylus keiferi*
Passalus dominicanus van Doesburg	
Passalus bucki Luederwaldt	
Passalus mucronatus Burmeister	*Heterocheylus keiferi*
Passalus spiniger Bates	*Heterocheylus laui*
Passalus abortirus Percheron	
Passalus binominatus erosus Truqui	*Heterocheylus* sp.
Passalus glaberrimus Moreira	
Passalus occipitalis Eschscholtz	
Passalus punctutostriatus Moreira	*Heterocheylus laui*
Passalus convexus Dalman	
Passalus caelatus Erichson	*Heterocheylus minus*

Passalid species	Heterocheylid species
Passalus elfridae Luederwaldt	
Passalus morio Percheron	
Passalus morio latifrons Percheron	
Passalus anguliferus Percheron	
Passalus interstitialis Eschscholtz	*Heterocheylus keiferi*
Passalus punctiger St. Fargeau & Serville	*Heterocheylus keiferi*
Passalus jansoni Bates	
Passalus olivus Kuwert	
Passalus pugionifer Kuwert	
Passalus toriferus Eschscholtz	
Passalus considerabilis Kuwert	*Heterocheylus* sp.
Passalus plicatus Percheron	*Heterocheylus* sp.
Passalus aduncus Erichson	
Passalus clypeoneleus Kuwert	*Heterocheylus* sp.
Passalus punctulatus Kaup	
Passalus pugionifer Kuwert	
Paxillus crenatus MacLeay	
Paxillus latisternus Kuwert	
Paxillus pleuralis Luederwaldt	*Heterocheylus* sp.
Paxillus camerani Rosmini	
Paxillus forsteri Luederwaldt	
Paxillus robustus Percheron	
Paxillus leachi MacLeay	*Heterocheylus transversus*
Ptichopus angulatus Percheron	*Heterocheylus* sp.
Chondrocephalus granulifrons Bates	
Chondrocephalus debilis Bates	
SOLENOCYCLINAE	
Semicyclus grayi Kaup	
Solenocyclus exaratus Klug	*Heterocheylus longispinosus*
Malagasalus honoratus Kuwert	*H. ?longispinosus*
Ciceronius morbillosus Klug	*Heterocheylus propinquus*
Pentalobus barbatus Fabricius	*Heterocheylus rossi*
Pentalobus barbatus savagei Percheron	
Pentalobus palinii Percheron	
Didimus africanus Percheron	*Heterocheylus brevispinus*
Didimus sansibaricus Harold	
Didimus aloysii-sabaudiae Pangella	
Didimus haroldi Kuwert	
Didimus congoensis Arrow	*Heterocheylus brevispinus*
Didimus ruwenzoricus Arrow	
Didimus punctipectus Kaup	
Erionomus platyplema Arrow	*Heterocheylus malkini*
Erionomus planiceps Eschscholtz	*Heterocheylus malkini*
Erionomus pilosus Aurivillius	*Heterocheylus malkini*

Passalid species	Heterocheylid species
MACROLININAE	
Labiens gigas Kaup	
Labiens ptox Kaup	*Heterocheylus nixus*
Labiens compergus Boisduval	*Heterocheylus rugosus*
Protomocoelus triumphator Zang	
Protomocoelus australis Boisduval	*Heterocheylus rugosus* *Heterocheylus nixus*
Gonatus pumilio Kaup	*Heterocheylus rugosus*
Gonatus schellongi Kuwert	*Heterocheylus rugosus*
Gonatus intermedius Kaup	
Gonatus minimus Kuwert	*Heterocheylus rugosus*
Gonatus minor Gravely	*Heterocheylus rugosus*
Macrolinus nicobaricus Gravely	
Macrolinus weberi Kaup	*Heterocheylus rugosus*
Macrolinus rotundifrons Kaup	*Heterocheylus rugosus*
Macrolinus sulciperfectus Kuwert	*Heterocheylus rugosus*
Macrolinus duivenbodei Kaup	
Macrolinus latipennis Percheron	
Pleurarius brachyphyllus Stoliczka	
Episphenus indicus Stoliczka	*Heterocheylus indicus*
Episphenus neelgherriensis Percheron	
Episphenus comptoni Kaup	
Ophrygonius cantori Percheron	*Heterocheylus maai*
Aceraius laevicollis Illiger	*Heterocheylus cavagnaroi*
Aceraius helferi Kuwert	
Aceraius illegalis Kuwert	*Heterocheylus cavagnaroi*
Aceraius grandis hirsutus Kuwert	*Heterocheylus cavagnaroi*
Aceraius lamellatus Gravely	*Heterocheylus cavagnaroi*
Pelopides tridens Wiedemann	
Pelopides dorsalis Kaup	
Plesthenus invitus Kuwert	
Mastochilus polyphyllus MacLeay	*Heterocheylus* sp. near *H. rugosus*
Mastochilus australasicus Percheron	*Heterocheylus lombardinii*
Mastochilus quaestionis Kuwert	
Pharochilus politus Burmeister	
Pharochilus dilatatus Dalman	
Pharochilus nitidulus MacLeay	*Heterocheylus lombardinii*
Analaches puberilis Kuwert	
Cetejus punctithorax Zang	
Cetejus peltostictus Kaup	*Heterocheylus rugosus*
LEPTAULACINAE	
Trichostigmus thoreyi Kaup	*Heterocheylus novellus*
Leptaulax bicolor Fabricius	*Heterocheylus bengalensis*
Leptaulax bicolor formosanus Doesburg	*Heterocheylus thai*
Leptaulax dentatus Fabricius	*Heterocheylus bengalensis*

GEOGRAPHIC DISTRIBUTION

The distribution of heterocheylids is the same as that of passalid beetles. These beetles are found between 45° north and 45° south latitudes, except for Europe and western North America, in areas receiving 20 or more inches of rain annually.

Nearly all heterocheylid species appear to be restricted to single species, or to closely related species groups, of passalids which have rather limited geographic distributions. These factors may be used to facilitate identification of the heterocheylid species, and may be the best way when comparative series of the mite species are not available.

Many of the beetles in the collection of the California Academy of Sciences are presently unidentified, with little likelihood of their being classified in the near future. The complete collection records for these beetles are included for each mite species and will provide a method for eventual correlation of the mite species with their passalid hosts.

The faunas of three geographical areas are treated separately herein. These areas are Africa, Asia and Australia, and North and South America.

PROCEDURE

Specimens of passalid beetles were slightly hydrated in 90 percent ethanol in micro Petri dishes. The elytra were partially lifted with a spatula, and the undersides flushed with alcohol from a pipette. The contents of the Petri dishes were then examined for mites under a dissecting microscope. The heterocheylids were treated in lacto-phenol (3:1 by volume) at 140° F. Lignin pink at 15 drops of 1/2 percent aqueous per pint of the lacto-phenol stained the specimens. Dehydration was accomplished in absolute isopropanol and the specimens were cleared in xylene. Preparations were made by placing a mite in xylene on a slide and then applying very thin Piccolyte as a hanging drop on the cover glass.

MORPHOLOGY

Heterocheylids are white, or off-white, dorsoventrally compressed mites. The palps are essentially inflexible and body length has been measured from the apex of the palps to the end of the anal valves. All values given for setae refer to their lengths. The major body divisions are identified in figure 1A. Characteristics of these segments are as follows:

GNATHOSOMA. This segment has the chelicerae fused to form a stylophor, the mouthparts are anterior, and a pair of adoral setae occur ventrally just behind the stylets. The palpal segmentation is indistinct, with the trochanter (fig. 1A *tr*)more or less obsolete, and the genu fused with the femur (fig. 1A *gen* + *fem*). The palpal coxa has one seta ventrally, the trochanter lacks setae, the femur bears one long seta dorsally, the genu bears one small seta dorsally, and the tibia and tarsus are fused (fig. 1B). The tarsus is presumed to be greatly reduced, and the tibia has four normal and one solenidiform setae.

PROPODOSOMA. This segment is often poorly defined and its length and width have been measured as indicated in figure 1C. Dorsally the stigma are at the anterolateral margins. Two pairs of setae occur near the anterior margin, and a pair of large ampullae (fig. 1A, ampulliform organ) occur at the posterior margin of the female. The males and immature stages have a pair of long setae instead of the ampullae. The males are easily distinguished from immatures by the obvious aedeagus visible within the opisthosoma. Ventrally, pedal coxae I bear a pair of setae and coxae II either one or two pairs. The setation of legs I and II are charted with those of III and IV in table 2.

HYSTEROSOMA. The dorsum is incompletely divided between legs III and IV and bears two pairs of short setae and a pair of long humeral setae (fig. 6G, *hs*). The venter consists mainly of coxae III and IV, and a median sternal shield bearing a pair of setae. Small lateral sternites are present at the anterolateral margins of the sternal shield in at least one species. Coxae III bear one or two pairs of setae and coxae IV lack setae.

OPISTHOSOMA. This segment has three distinct subdivisions dorsally. The anterior division we term the intercalary, and the longer dorsal setae are labeled as *IM*, the shorter setae as *Im*. The middle division is named the suranal, and the anterolateral setae are labeled *Sl*, the median or posterior setae *Sm*. The anal valves bear two pairs of setae, the anterolateral pair are labeled *Al*, the posterior pair *Am*. The absolute and the relative lengths of the opisthosomal setae are characteristic and allow the easiest recognition of many species. Ventrally the intercalary and suranal segments are jointly covered by paragenital plates bearing a single pair of setae.

LEGS. The number of setae on each leg segment is relatively constant for the species, and is useful also in distinguishing the immature stages. The normal numbers of setae and the variations are given in table 2. The lengths and positions of these setae, particularly of the tarsi, are of taxonomic importance. The two longer setae of tarsus IV are referred to frequently and are designated *D* for the dorsal seta and *P* for the posterior seta (figs. 6D, 6E).

The immature stages of heterocheylids are easily recognized by characters of the legs. The larvae have three pairs of legs (fig. 15D) with normal setation. The protonymph has four pairs of legs, the fourth pair (fig. 11C) with all segments except the tarsi lacking setae, and occasionally with a single macroseta on the tibia. The deutonymph has normal setation on all four legs and is distinguished from the male by elongate anal valves (fig. 3B), and from the females by the lack of ampulliform organs.

Characters used in the discrimination of species include size of body and sculpture of the cuticle; difference in the number of setae on pedal coxae II and III, and tarsi II, III and IV; differences in the shape and placement of the ampulliform organs; differences in the relative lengths and positions of the setae, particularly those of the palps, tarsi, coxae and opisthosoma, and differences in the shape of tarsus I of the females. Divergence from the nymphal stages is greater for the female than for the male. For this reason, in addition to their greater abundance, the taxonomy is based on the female sex.

TABLE 2. Chaetotaxy of legs I to IV.

Segment	Female	Male	Deutonymph	Protonymph	Larva
Coxa I	1	1	1	1	1
Coxa II	1 or 2	1 or 2	1 or 2	1	1
Coxa III	1 or 2	1 or 2	1 or 2	2	1
Coxa IV	0	0	0	0	--
Troch. I-IV	0	0	0	0	--
Femur I	2	2	2	2	2
Femur II	1	1	1	1	1
Femur III	1	1	1	1	1
Femur IV	1	1	1	0	--
Genu I	1	1	1	1	1
Genu II	0	0	0	0	0
Genu III	0	0	0	0	0
Genu IV	0	0	0	0	--
Tibia I	6 + 1*	6 + 1	6 + 1	6 + 1	5 + 1 or 5 + 2
Tibia II	4 + 1	4 + 1	4 + 1	4 + 1	4 + 1
Tibia III	4	4	4	4	4
Tibia IV	4 + 1	4 + 1	4 + 1	0 or 1	--
Tarsus I	10	10	10	10	8
Tarsus II	4 + 1 or 5 + 1	5 or 6	6 + 1	6 + 1	6 + 1
Tarsus III	5 or 6	5 or 6	5 or 6	5 or 6	5
Tarsus IV	4 or 5	4 or 5	4 or 5	4	--

*Solenidiform setae

KEY TO AFRICAN *HETEROCHEYLUS* FEMALES

1. Propodosoma narrow, as long or longer than wide (figs. 4A, C)...3
Propodosoma wide, distinctly wider than long (Figs. 2A, 3D).....2

2(1). Ampullae with posterior margin level with posterior propodosomal margin (fig. 2A)....................................*H. rossi*
Ampullae not reaching posterior propodosomal margin, their posterior margins removed by approximately the length of the ampullae (fig. 3D)..........................*H. recessus*

3(1). Tarsi IV of uniform diameter (fig. 5B)..........................4
Tarsi IV medianly constricted with setae D and P approximately inserted on expanded apex (fig. 5E)...........*H. propinquus*

4(3). Genual setae of legs II - IV not extending beyond caruncles...*H. brevispinus*
Genual setae of legs II - IV extending beyond caruncles by at least 25% length of setae.................................5

5(4). Smaller species, length less than 400μ; setae Im anterior to setae IM...*H. malkini*
Larger species, length about 450μ; setae Im anteromesad to IM.......................................*H. longispinosus*

Heterocheylus rossi Schuster and Lavoipierre, new species.
(Figures 1B, 2A - E, 3A, B.)

FEMALE (Holotype). Body 435μ long, 195μ wide; heavily sclerotized, plates micropunctate. Palpal genual seta extending slightly beyond apex of palp. Propodosoma dorsum longitudinally rugose; lateral setae 6μ, median setae 13μ; pore subequal in size to setal insertion located laterad of median setae; ampullae large, 20μ long, 11μ wide, separated by 57μ between centers. Metapodosoma with 2 pairs of setae about 10μ; humeral setae 154μ. Intercalary segment with setae IM 170μ, setae Im 10μ, located mesad and just anterior to base of setae IM. Suranal setae Sl 165μ, setae Sm 130μ. Anal valves with setae Al 120μ, Am 59μ. Paragenital setae 10μ. Coxae I with single pair of setae. A pair of small lateral sternites occur to the side of sternal plate anterior to coxae III. Tarsus of leg II as wide or wider than tibia, widest at middle, bearing 5 setae and small solenidiform seta; tarsal claw distinctly striate; tarsi III and IV with setae D in basal half of segment, insertions of D and P distant.

MALE. Body 410μ long, 180μ wide. Propodosoma with pair of discal setae 100μ. Metapodosomal venter without lateral sclerites. Tarsus II with normal claw, five setae and one solenidiform seta. Tarsus IV with seta D located in basal half.

The number of individuals of each stage and their range in lengths are as follows for a sample of 41 specimens.

Females	17	415μ to 485μ
Deutonymphs moulting to females	3	540μ to 580μ
Deutonymphs	13	470μ to 550μ
Protonymph	1	436μ
Larvae	3	278μ to 295μ
Males	4	370μ to 415μ

A considerable amount of variation in overall size is matched by differences in most measurable characteristics. Usually the larger specimens tend to have longer setae so that the general facies remains similar. Variation in length of four characters is given in table 3 for *H. rossi* females (n = 24, 25).

TABLE 3. Variation in length of 4 characters of *H. rossi* females.

	Min.	Max.	Mean	Median
Body (n 25)	420μ	504μ	465μ	470μ
Tarsus IV Seta P (n 24)	31μ	48μ	40.2μ	40μ
Tibia IV Macroseta (n 24)	98μ	123μ	110.5μ	111μ
Intercalary Seta IM (n 24)	169μ	219μ	197μ	198μ

TYPE SERIES. The holotype female CAS 10,372, 3 paratype females and 2 protonymphs, UGANDA, Maragambo For., Q. E. Park, 1,000 m., XII-4-1957, E. S. Ross, R. E. Leech. Additional paratypic material is from: CAMEROON REPUBLIC (British Cameroons), 12 females, 2 males, 14 deutonymphs, 4 protonymphs, 3 larvae, Matute, Tiko Plantation, IV-24 to V-6-1949, B. Malkin. CAMEROON REPUBLIC (French Cameroons), 1 female

Yaounde, *Pentalobus barbatus* Fabricius,VII-25-1949, B. Malkin. ANGOLA, 1 female, 2 protonymphs, Vila Salazar, *Pentalobus barbatus*, IX-8-1949, B. Malkin. REPUBLIC OF THE CONGO (Belgian), 1 female, Kama Mission, VIII-14-1957, E. S. Ross, R. E. Leech; 6 females, 3 males, 29 km. north Matadi, VII-25-1957, E. S. Ross, R. E. Leech; 1 female, 2 males, 2 deutonymphs, 120 km. west Popokabaka, VIII-2-1957, E. S. Ross, R. E. Leech; 2 females,27 km. west Tshikapa, VIII-9-1957, E. S. Ross, R. E. Leech. NIGERIA, 1 female, 1 male, 2 protonymphs, Ikom Ogoja Prov., VII-1-1949, B. Malkin; 15 females, 2 males, 1 deutonymph, Iser. Lagos, III-28-1949, *Pentalobus barbatus*, B. Malkin.

HOST DISTRIBUTION. *Pentalobus barbatus* Fabricius.

GEOGRAPHIC DISTRIBUTION. Uganda, Nigeria, Republic of the Cameroon, Republic of the Congo, Angola.

DISCUSSION. This is a large distinctive species characterized by the wide propodosoma with ampullae reaching the posterior margin, expanded tarsi I, and seta D of tarsi being distinctly basal to seta P. The males are recognized by the position of setae on tarsus IV and by the lengths of the opisthosomal setae.

Dr. E. S. Ross, for whom this species is named, has collected numerous passalid beetles during his trips to many countries.

Heterocheylus recessus Schuster and Lavoipierre, new species.
(Figures 3C-E.)

FEMALE (Holotype). Body 370μ long, 175μ wide; palpal genual seta not extending to apex of palp. Propodosoma longitudinally reticulate anterior to ampullae; lateral setae 6μ, median setae 10μ; pore subequal in size to setal insertion located near each median seta; ampullae 15μ long, 10μ wide, removed by about their own length from posterior propodosomal margin, separated by 43μ between centers. Metapodosoma bearing two pairs of setae about 8μ; humeral setae 107μ. Intercalary segment with IM 92μ, Im 9μ, located anteromesad to IM. Setae Sl 85μ, Sm 67μ. Anal valves with setae Al 57μ, Am 34μ. Paragenital setae 9μ. Coxae I with single pair of setae. Tarsus II with 5 setae. (The lengths of 15 females varied from 356μ to 390μ, with a mean of 372μ).

MALE. Body 292μ long, 135μ wide; propodosoma with pair of discal setae 70μ; humeral setae 83μ.

TYPE SERIES. The holotype female CAS 10,373, 14 paratype females, 3 paratype males, and 1 deutonymph from REPUBLIC OF THE CONGO, 27 km.west Tshikapa, VIII-9-1957, E. S. Ross, R. E. Leech. The specimens were taken from a series of unidentified passalids.

HOST DISTRIBUTION. Unknown.

GEOGRAPHIC DISTRIBUTION. Republic of the Congo.

DISCUSSION. This species is related to *H. rossi*, differing by being smaller and by the more anterior position of the ampullae. The male is comparable to the female in the general facies of the opisthosoma and tarsi IV. The shorter opisthosomal setae best distinguish the males from those of *H. rossi*.

Heterocheylus malkini Schuster and Lavoipierre, new species.
(Figures 4A, B.)

FEMALE (Holotype). Body 393μ long, 144μ wide; weakly sclerotized, plates smooth, not punctate. Palpal genual seta not extending to apex of palp. Propodosoma with lateral setae 5μ, median setae 10μ; without pore associated with either pair of setae; ampullae 12μ long, 9μ wide, separated by 40μ between centers. Metapodosoma with 2 pairs of setae about 9μ long; humeral setae 160μ long. Intercalary segment with IM 105μ, Im 9μ located anterior to insertions of IM. Suranal setae Sl 85μ, Sm 77μ. Anal valves with setae Al 50μ, Am 37μ. Paragenital setae 9μ. Coxae I with single pair of setae. Tarsus II tapered, not as wide as tibia; bearing 5 normal and 1 solenidiform setae; claw not striate. Tarsus IV with 4 setae, D slightly basal to P. (8 females 356μ to 395μ, mean 376μ).

MALE. Body 345μ long, 150μ wide. Propodosoma with discal setae 94μ long, humeral setae 90μ.

TYPE SERIES. The holotype female CAS 10,374 is from CAMEROON REPUBLIC (British), Matute, Tiko Plantation, IV-24 to V-6-1949, B. Malkin; same data, 5 females, 1 deutonymph, *Erionomus pilosus* Aurivillius; 1 deutonymph, Sappo near Buea, III-1951, S. Tita; 1 female, 2 males, 1 protonymph, 1 deutonymph moulting to female, Buea slope, Mt. Cameroon, 1,372 m., *Erionomus pilosus,* V-14-1949, B. Malkin; 1 female, Victoria, *Erionomus pilosus,* V-1949, B. Malkin; 1 female, 2 deutonymphs, Victoria, Muyuka, *Erionomus pilosus,* VI-27-1949, B. Malkin.

Other specimens not included in the paratypic series are from CAMEROON, Edea, *Erionomus planiceps* Eschscholtz, E. R. Leach, and CAMEROON REPUBLIC (British), Sasse near Buea, Mt. Cameroon, 1,067 m., *Erionomus platypleura* Arrow, II-1951, S. Tita.

Specimens from the CAMEROON REPUBLIC (Fr.), Bindiba Subd. de Betare-Oya, *Didimus congoensis,* and REPUBLIC OF THE CONGO, Lwiro R., 47 km. north Bukavu are questionably of this species. The humeral setae of female specimens from the former locality are thicker, and seta D of tarsus IV of the females from the latter locality are longer and blunter than normal.

HOST DISTRIBUTION. *Erionomus pilosus* Aurivillius, *E. planiceps* Eschscholtz, and *E. platypleura* Arrow.

GEOGRAPHIC DISTRIBUTION. Cameroon Republic.

DISCUSSION. This species is closely related to *H. brevispinus* and the differences are discussed following the description of that species. Borys Malkin collected many of the African passalids now in the Academy's identified collection, and the name of this species is in appreciation of his efforts. Males and immatures must have been identified as this species primarily on the basis of host association.

Heterocheylus brevispinus Schuster and Lavoipierre, new species.
(Figures 4C - F.)

FEMALE (Holotype). Body 360μ long, 138μ wide. Genual seta of palp not extending to apex of palp. Propodosoma dorsum 80µ long, 90µ wide, longitudinally striate; lateral setae 5µ, median setae 9µ, without associated pore; ampullae 11µ long, 9µ wide, separated by 32µ between centers. Metapodosoma bearing 2 pairs short setae about 9µ; humeral setae 110µ. Intercalary segment with IM 80µ, Im 7µ located anterior to IM. Suranal segment with Sl 77µ, Sm 60µ. Anal valves with setae Al 50µ, Am 34µ. Paragenital setae 8µ. Coxae I with one pair of setae. Tarsus II with 5 normal and 1 solenidiform setae. Tarsus IV with 4 setae, D slightly basal to P. (17 females 345µ to 380µ, mean 363µ).

MALE. Body 292µ long, 106µ wide. Propodosoma with pair of discal setae 90µ long. Lengths of posterior setae: IM 72µ, Im 5µ, Sl 46µ, Sm 50µ, Al 34µ, and Am 29µ. (5 males 270µ to 302µ, mean 286µ).

LARVAE AND PROTONYMPH. Unknown.

DEUTONYMPH. Three examples 312µ to 345µ.

TYPE SERIES. Holotype female CAS 10,375, 5 paratype females, CAMEROON REPUBLIC (British), Cameroon Mt., Buea Slope, 1,372 m., *Didimus africanus* Percheron, V-14-1949, B. Malkin. Other paratypic specimens were from CAMEROON REPUBLIC: 5 females, 3 males, 1 deutonymph, Sasse-Sappo, *Didimus africanus*, III-1959, S. Tita; 2 females, 1 male, 1 deutonymph, Sasse near Buea, Mt. Cameroon, 1,067 m., *Didimus africanus*, S. Tita; 2 females, 1 male, Irumu, *Didimus africanus*, V-15-1956, V. Allard. Two specimens from French Congo, CAMEROON REPUBLIC (Fr.), from *Didimus congoensis* Arrow appear to be conspecific.

HOST DISTRIBUTION. *Didimus africanus* Percheron, and *D. congoensis* Arrow.

GEOGRAPHIC DISTRIBUTION. Cameroon Republic and Republic of the Congo.

DISCUSSION. This species is closely related to *H. malkini*. The humeral setae, caudal setae and leg setae are consistently shorter, although the size range and distribution of the two species overlap. The humeral setae of *H. brevispinus* are approximately 110µ, those of *H. malkini* are about 150µ.

Heterocheylus longispinosus Schuster and Lavoipierre, new species.
(Figures 5A, B.)

FEMALE (Holotype). Body 450µ long, 175µ wide. Propodosoma longitudinally reticulate laterally. Palpal genual seta extending slightly beyond apex of palp. Propodosoma 116µ long, 113µ wide; lateral setae 7µ, median setae 13µ, apparently without pores associated with either seta; ampullae 15µ long, 10µ wide, separated by 38µ between centers. Metapodosoma bearing 2 pairs of setae 9µ; humeral setae 178µ. Intercalary segment with IM 175µ, Im 10µ, located anteromesad of IM. Suranal segment with Sl 165µ, Sm 145µ. Anal valves with setae Al 113µ, (Am broken; est. 65 - 70µ from width at base). Paragenital setae 11µ. Coxae I with 1 pair of setae; coxae III with 2 pairs of setae. Tarsus III with 6 setae, tarsus IV with 4 setae, with P inserted at middle and remainder in distal half.

TYPE SERIES. The unique female holotype CAS 10,376 from MALAGASY (MADAGASCAR), Nossibé, Branisik, *Solenocyclus exaratus* Klug, A. Fenyes.

GEOGRAPHIC DISTRIBUTION. Malagasy.

HOST DISTRIBUTION. *Solenocyclus exaratus* Klug, *Malagasalus honoratus* Kuwert.

DISCUSSION. The general facies of this animal is similar to that of *H. malkini*. *Heterocheylus longispinosus* is most easily distinguished from that species by the larger size and by the Im setae being closer and more mesally positioned to setae IM.

Two damaged female specimens from beetles identified as *Malagasalus honoratus*, from Tananarive, Malagasy, are of either the same or a closely related species.

Heterocheylus propinquus Schuster and Lavoipierre, new species.
(Figures 5D, E.)

FEMALE (Holotype). Body 400μ long, 158μ wide; sclerotized, the plates micropunctate. Palpal genual seta extending beyond apex of palp. Propodosoma faintly rugose longitudinally; lateral setae 5μ, median setae 10μ; ampullae 12μ long, 8μ wide, separated by 42μ between centers. Metapodosoma with 2 pairs of setae about 10μ; humeral setae 152μ. Intercalary segment with setae IM 144μ, Im 8μ, located anteromesad to IM. Suranal setae Sl 144μ, Sm 144μ; anal valves with setae Al 88μ, Am 67μ. Paragenital setae 10μ. Coxae I with 1 pair of setae. Tarsus II with 5 setae and 1 solendium; tarsi III and IV with posterior margin expanded in distal half; setae D and P approximately inserted, both in distal half of tarsal segment.

MALE. Unknown.

TYPE SERIES. Holotype female CAS 10,377, 1 paratype deutonymph, from D'Arivonimamo, MALAGASY, *Ciceronius morbillosus* Klug, Jan. 1927. Additional paratypes from MALAGASY: 1 female, Midonoy S G, *Ciceronius morbillosus*, Oct. 1929, R. Vitalis de Salvaza; 1 female, Tananarive, *Ciceronius morbillosus*, III-6 to 20-1951. A single, imperfect female, also from *C. morbillosus*, collected at Midonoy is considerably smaller than the other specimens and probably represents an undescribed species.

HOST DISTRIBUTION. *Ciceronius morbillosus* Klug.

GEOGRAPHIC DISTRIBUTION. Malagasy.

DISCUSSION. Although essentially similar to *H. brevispinus* and *H. malkini*, this species has generally longer setae, and tarsi III and IV are constricted before the level of setae D and P.

KEY TO ASIAN AND AUSTRALIAN *HETEROCHEYLUS* FEMALES

1. Coxae III with 2 pairs of setae; tarsus III usually with 6 setae, a minute basal posterior seta present (fig. 7B).....2
Coxae III with 1 pair of setae; tarsus III with 5 setae, the minute basal posterior seta absent (fig. 6C).............12

2(1). Tarsus III with 6 setae................................3
Tarsus III with 5 setae.........................*H. indicus*

3(2). Ampullae distant......................................4
Ampullae approximate or contiguous (fig. 1A)......*H. lombardinii*

4(3). Ampullae minute, spherical (fig. 9D), or ampullae elongate with length at least twice width (figs. 12E, F)...........5
Ampullae normal, less than twice as long as wide..............7

5(4). Ampullae elongate, flattened, twice as long as wide (figs. 12E, F)..6
Ampullae minute, spherical (fig. 9D)..................*H. parvus*

6(5). Distal margin of ampullae subquadrate (fig. 12F)........*H. becki*
Distal margin of ampullae rounded or pointed (fig. 12E).........
....*H. novellus*

7(4). Seta IM extending to or beyond end of opisthosoma............8
Seta IM short, not extending past suranal segment (fig. 8C)... ....*H. cavagnaroi*

8(7). Seta Sm longer than seta Al or Am...........................9
Seta Sm minute, shorter than either Al or Am (fig. 12A)........ ....*H. incohatus*

9(8). Inner ramus of palp tarsus not distinctly sclerotized........10
Inner ramus of palp tarsus distinctly sclerotized (fig. 11E)... ....*H. nixus*

10(9). Dorsal seta of genu III and IV extending beyond end of tarsus (fig. 7D).....................................11
Dorsal seta of genu III and IV not extending to end of tarsus (fig. 9A).....................................*H. maai*

11(10). Dorsal seta of femur I extending to apex of tibia I; dorsal seta of tarsus IV extending beyond caruncle (fig. 8A)..... ....*H. rugosus*
Dorsal seta of femur I not extending to apex of tibia I; dorsal seta of tarsus IV extending only to apex of caruncle (figs. 7C, D)....................................*H. exiguus*

12(1). Tarsus III with 6 setae, a small basal posterior seta present.. ....*H. thai*
Tarsus III with 5 setae, basal posterior seta absent.......... ....*H. bengalensis*

Heterocheylus bengalensis Schuster and Lavoipierre, new species.
(Figures 6A - D.)

FEMALE (Holotype). Body 350μ long, 145μ wide; propodosoma reticulate, hysterosoma longitudinally striate. Palpal genual seta extending beyond apex of palp. Propodosoma 84μ long, 112μ wide, micropunctate; lateral setae 6μ, median setae 9μ; obscure pore within 1 setal length of median setae; ampullae 12μ long, 9μ wide, separated by 40μ between centers. Metapodosoma with 2 pairs of setae about 9μ; humeral setae 120μ. Intercalary segment with setae IM 98μ; Im 8μ, located anterior and mesad to IM. Suranal setae Sl 77μ, Sm 67μ. Anal valves with setae Al 47μ, Am 30μ. Paragenital setae 8μ. Tarsus IV with 4 setae, seta P one-half length of D, seta D located basally. Coxae III with single pair of setae.

MALE. Body length 255μ long, 110μ wide. Propodosoma 60μ long, 75μ wide, with posterior discal setae 60μ. Humeral setae 70μ. Coxae III with 1 pair of setae.

TYPE SERIES. The holotype female CAS 10,392, 3 female and 3 deutonymph paratypes from EAST PAKISTAN, West Bengal, 8 km. south Rongpo, 375 m., X-17-1961, E. S. Ross, D. Q. Cavagnaro. Additional paratypic specimens from EAST PAKISTAN are 5 female, 2 male and 4 immatures, Chnicknagul, 16 km. north Sylhet, 10 m., IX-30-1961, E. S. Ross, D. Q. Cavagnaro. Body length of the 13 females varied between 326μ and 359μ with a mean of 346μ. The mean length for the 5 specimens from Rongpo was 350μ, for Chnicknagul 344μ.

Specimens that appear to be conspecific are from THAILAND, Khau-Yai Nat. Pk.; FORMOSA, Hori, *Leptaulax bicolor formosanus* Doesburg; PHILIPPINES, Kabasalan, Mindanao, *Leptaulax dentatus* Fabricius. While the type series was taken from unidentified species of passalids, the other records indicate that the type series was probably associated with a species of *Leptaulax*.

GEOGRAPHIC DISTRIBUTION. East Pakistan, Formosa, Philippines.

HOST DISTRIBUTION. *Leptaulax bicolor formosanus* Doesburg, *Leptaulax dentatus* Fabricius.

DISCUSSION. This species lacks the small anterolateral setae of coxae III, a characteristic separating it from all other species of *Heterocheylus* except *H. thai*. The anterolateral coxal setae appear to be absent from the male and both nymphal stages also.

Heterocheylus thai Schuster and Lavoipierre, new species.
(Figure 5C.)

FEMALE (Holotype). Body 333μ long, 140μ wide; propodosoma weakly reticulate, metasoma longitudinally striate. Palpal genual seta not extending beyond apex of palp. Propodosoma 76μ long, 84μ wide, micropunctate; lateral setae 5μ, median setae 12μ; a pore associated with each median seta; ampullae 11μ long, 7μ wide, separated by 39μ between centers. Metapodosoma with 2 pairs of setae 9μ; humeral setae 115μ. Intercalary segment with setae IM 90μ, Im 9μ located anterior to IM. Suranal setae Sl 54μ, Sm 54μ. Anal valves with setae Al 42μ, Am 15μ. Paragenital setae 13μ. Tarsus IV with 4 setae, with seta D basal to P.

MALE AND IMMATURE STAGES. Unknown.

TYPE SERIES. Holotype female CAS 10,383 and 1 paratype female were collected in THAILAND, Khao-Yai Nat. Park, 750 m., VII-26-62 by E. S. Ross and D. Q. Cavagnaro.

GEOGRAPHIC DISTRIBUTION. Thailand.

HOST DISTRIBUTION. Unknown.

DISCUSSION. This species is similar to *H. bengalensis* in lacking the small anterolateral setae of coxae III. Except for the coxae III setae, it is similar to *H. exiguus* in respect to setal pattern, but the posterior setae of coxa III is longer and the anal valve setae Am are longer than for that species.

Heterocheylus indicus Schuster and Lavoipierre, new species.
(Figures 6E - G, 7A.)

FEMALE (Holotype). Body 467μ long, 170μ wide; propodosoma slightly reticulate at basolateral angles. Palpal genual seta extending slightly beyond apex of palp. Propodosoma 105μ long, 105μ wide; lateral setae 8μ, median setae 16μ; ampullae 16μ long, 11μ wide, separated by 38μ between centers. Metapodosoma with 2 pairs of setae about 9μ; humeral setae 109μ. Intercalary segment with setae IM 108μ, Im 8μ, located essentially anterior to IM. Suranal setae Sl 84μ, Sm 82μ. Anal valves with setae Al 51μ, Am 39μ. Paragenital setae 14μ. Coxae III with 2 pairs of setae; tarsus III without basal posterior seta, 5 setae present. Setae D and P of tarsi II - IV inserted approximately on distal posterior expansion.

MALE. Body 383μ long, 140μ wide. Propodosoma with pair of discal setae 84μ. Humeral setae 100μ.

MEASUREMENTS. Observed variation in the lengths of individuals is as follows: 12 females 326μ to 467μ, mean 410μ; 7 deutonymphs 378μ to 480μ, mean 437μ; 7 protonymphs 320μ to 369μ, mean 334μ; 1 larva 245μ; 7 males 330μ to 415μ, mean 326μ.

TYPE SERIES. The holotype female CAS 10,378, 3 female, 2 male, 3 deutonymph and 6 protonymph paratypes were collected at SOUTH INDIA, 13 km. northeast Munnar, 1,890 m., III-20-1962, E. S. Ross, D. Q. Cavagnaro. Additional paratypic specimens, also from INDIA are: 1 female, 3 males, 12 km. northeast Mercara, 100 m., II-22-1962, E. S. Ross, D. Q. Cavagnaro: 2 deutonymphs, Anamalai Hills, Chichone, *Episphenus indicus* Stoliczka, XI-1949, P. S. Nathon; 2 females, 1 larva, Anamalai Hills, 760 m., III-18-1962, E. S. Ross, D. Q. Cavagnaro: 4 females, 3 males, 3 deutonymphs, 1 protonymph, Kodaikanal, 2,000 m., III-30-1962, E. S. Ross, D. Q. Cavagnaro.

GEOGRAPHIC DISTRIBUTION. South India.

HOST DISTRIBUTION. *Episphenus indicus* Stoliczka.

DISCUSSION. Unlike *H. thai* and *H. bengalensis,* both pairs of coxae III setae are present. Tarsi are medianly constricted with the dorsal setae occurring on the expanded apex. Only the distal posterior setae are present on tarsi II - IV so that none of these tarsi bear more than five setae. The best preparation, that selected as the type, is the largest female specimen.

Heterocheylus exiguus Schuster and Lavoipierre, new species.
(Figures 7B - E.)

FEMALE (Holotype). Body 356μ long, 127μ wide; propodosoma and metapodosoma longitudinally striate. Palpal genual seta not extending to apex of palps. Propodosoma 87μ long, 91μ wide; lateral setae 5μ, median setae 9μ; ampullae 11μ long, 8μ wide, separated by 25μ between centers. Metapodosoma with 2 pairs of setae 8μ; humeral setae 109μ. Intercalary segment with setae IM 95μ, Im 8μ, located anterior and slightly mesad to IM. Suranal setae Al 85μ, Sm 67μ. Anal valves with setae Al 48μ, Am 38μ. Paragenital setae 11μ. Coxae III with both pairs of setae. Tarsus IV with 4 setae, setae D and P located at about the same level.

MALE. Body 260μ long, 92μ wide. Propodosoma 60μ long, 65μ wide, with a pair of discal setae 65μ. Humeral setae 76μ.

TYPE SERIES. Holotype female CAS 10,379, and 7 female and 2 male paratypes were collected in THAILAND, Khao-Yai Nat. Park, 750 m., VII-26-1962, E. S. Ross, D. Q. Cavagnaro.

GEOGRAPHIC DISTRIBUTION. Thailand.

HOST DISTRIBUTION. Unidentified passalids.

DISCUSSION. The females and deutonymphs have two pairs of setae on coxae III. The two associated males appear to have only a single pair of setae on coxae III, which would relate them to the males of *H. bengalensis*. However, the setae of the palp trochanter are shorter than those of *H. bengalensis*.

Heterocheylus rugosus Schuster and Lavoipierre, new species.
(Figures 8A, B.)

FEMALE (Holotype). Body 360μ long, 148μ wide; propodosoma and metapodosoma longitudinally striate. Palpal genual seta not extending to apex of palp. Propodosoma 80μ long, 90μ wide; lateral setae 8μ, median setae 11μ; ampullae 12μ long, 8μ wide, separated by 38μ between centers. Metapodosoma with 2 pairs of setae 8μ; humeral setae 110μ. Intercalary segment with seta IM 93μ, Im 8μ located anterior and mesad to IM. Suranal setae Sl 84μ, Sm 73μ. Anal valves with setae Al 55μ, Am 47μ. Paragenital setae 10μ. Coxae III with 2 pairs of setae. Tarsus III with 6 setae; tarsus IV with 4 setae in distal half, setae D and P with approximate insertions.

MALE. Body 325μ long, 128μ wide; propodosoma 72μ long, 100μ wide, with a pair of discal setae 80μ. Humeral setae 87μ.

TYPE SERIES. The holotype female CAS 10,380, 5 female, 3 male, 6 deutonymph and 1 protonymph paratypes from Papua, NEW GUINEA, Daru, mouth of Fly River, *Gonatas pumilio* Kaup (holotype), *Cetejus peltostictus* Kaup, *Protomocoelus australis* Boisduval, VII-1941, R. G. Wind. Additional paratypes are from the following collections: NEW GUINEA, Finschhafen, *Cetejus peltostictus*, IV-1944, E. S. Ross; 5 female, 1 male, 1 deutonymph, Maffin Bay, *Gonatas schellongi* Kuwert, IX-10-1944, E. S. Ross. Specimens considered conspecific but not included in the paratypic series from the SOLOMON ISLANDS, Bougainville, *Gonatas minimus* Kuwert, VII-1945, A. J. Walz, and Truk, Tol Mt. Umpot, *Gonatas minor* Gravely, IV-9-1949, R. W. L. Potts.

Additional specimens from the following localities are very similar and may also be of this species: CEYLON, *Macrolinus rotundifrons* Kaup; PHILIPPINES, Mindanao, *Macrolinus weberi* Kaup, II-1-1932, H. C. Muzzal; "SOMARISE-SALEIER," *Macrolinus sulciperfectus* Kuwert, XII-1938, Kalisly. A single specimen, related but probably representing a distinct species is from AUSTRALIA, New South Wales, *Mastochilus polyphyllus* MacLeay, Deuquet Collection.

GEOGRAPHIC DISTRIBUTION. New Guinea, Solomon Islands.

HOST DISTRIBUTION. *Gonatas pumilio* Kaup, *G. schellongi* Kuwert, *G. minimus*, *G. minor* Gravely, *Cetejus peltostictus* Kaup, *Protomocoelus australis* Boisduval.

DISCUSSION. This species is similar to *H. exiguus*, differing by the wider propodosoma, longer dorsal seta of femur I, and longer dorsal setae of tibia III and IV.

Heterocheylus cavagnaroi Schuster and Lavoipierre, new species.
(Figures 8C - E.)

FEMALE (Holotype). Body 525μ long, 215μ wide; dorsum reticulate, all longer setae expanded distally. Palpal genual seta extending beyond apex of palp. Propodosoma 120μ long, 150μ wide; lateral setae 9μ, median setae 12μ; ampullae 15μ long, 13μ wide, separated by 42μ between centers. Metapodosoma with 2 pairs of setae 13μ; humeral setae 124μ. Intercalary segment with seta IM 32μ, Im 11μ, located mesad and slightly anterior to IM. Suranal setae Sl 59μ, setae Sm 73μ. Anal valves with setae Al 39μ, Am 25μ. Paragenital setae 12μ. Coxae I with single pair of setae; coxae III with 2 pairs. Tarsi III and IV with setae D and P distant, both in apical half of segment, with P basal to D.

MALE. Body 370μ long, 150μ wide. Propodosoma with a pair of setae 80μ. Humeral setae 110μ.

TYPE SERIES. Holotype female CAS 10,381, and the following paratypes: 13 female, 1 male, 1 deutonymph, 4 protonymphs, and 2 larvae from THAILAND, East slope Doi Sutep, 875 m. to 1,275 m.,VII-15-1962, E. S. Ross, D. Q. Cavagnaro. Additional paratypes, also from THAILAND, are as follows: 11 female, 4 male, 3 deutonymph, 2 protonymph, 1 larva, Khao-Yai Nat. Park, 750 m., VII-26-1962, E. S. Ross, D. Q. Cavagnaro.

Specimens considered to be conspecific but not paratypic are 5 females, 1 male from FORMOSA, Hassezen and Hori, collected in 1934 and 1935 by J. Gressitt from *Aceraius grandis hirsutus* Kuwert, and from the following PHILIPPINE localities: 2 females, Mt. Makiling, Laguna, *Aceraius laevicollis* Illiger; 1 female, 2 males, 2 deutonymphs, Kabasalan, Mindanao, Zamboanga, *Aceraius laevicollis*, V-1-1932, H. C. Muzzal; 1 female, 1 male, 1 deutonymph, Silipon Bur Forest, Mindanao 915 m. - 1,200 m., *Aceraius lamellatus* Gravely and *A. illequalis* Kuwert, VI-10 and 24-1932, L. Philips; 1 female, 1 deutonymph, Mabato Gato Pili, Camarines Sur, Luzon, *Aceraius laevicollis*, V-16-1931.

GEOGRAPHIC DISTRIBUTION. Thailand, Formosa and Philippines.

HOST DISTRIBUTION. Various species of *Aceraius*.

DISCUSSION. *Heterocheylus cavagnaroi* is easily recognized by the short IM setae and the positions of tarsal IV setae D and P. Thirty-one females range in size from about 457μ to 530μ with a rather uniform distribution. Setal lengths are quite variable, between complimentary setae on individuals, and between individuals of the same and different populations. Specimens from Khao-Yai tend to be smaller than those from Doi Sutep. The type is one of the larger females. Minimum, maximum and (mean) values for measurements of 30 females are: body length 457μ, 531μ (495μ); length of humeral setae 97μ, 135μ (116μ); IM 24μ, 50μ(31μ); Sl 50μ, 76μ (62μ); Sm 61μ, 84μ (71μ), Al 34μ, 54μ (42μ); and Am 21μ, 30μ(25μ).

Heterocheylus maai Schuster and Lavoipierre, new species.
(Figures 9A - C.)

FEMALE (Holotype). Body 465μ long, 185μ wide; propodosoma weakly reticulate in posterolateral areas. Palpal genual seta extending beyond apex of palp. Propodosoma 109μ long, 122μ wide; lateral setae 6μ, median setae 11μ; ampullae 15μ long, 12μ wide, separated by 38μ between centers. Metapodosoma with 2 pairs of setae 8μ; humeral setae 104μ. Intercalary segment with setae IM 97μ; Im 8μ, located anteromesad to IM. Suranal setae Sl 72μ, Sm 76μ. Anal valves with setae Al 53μ, Am 35μ. Paragenital setae 8μ. Coxae III with 2 pairs of setae. Tarsus IV widest in distal half, with 4 setae, setae D and P located at about the same level.

MALE. Body 386μ long, 150μ wide. Propodosoma 85μ long, 95μ wide, with a pair of setae 87μ. Humeral setae 100μ.

TYPE SERIES. The holotype female CAS 10,382, 38 female, 12 male, 6 deutonymph, 9 protonymph, and 1 larva paratypes were collected at SOUTH CHINA, Fukien, Shawu Tachuian, *Ophrygonius cantori* Percheron, various dates 1942 and 1943, T. C. Maa.

Additional examples, not included in the type series, are from: EAST HIMALAYAS, 2,130 m. - 2,410 m., *Ophrygonius cantori*, V-10-1940, R. B. Horsfall. NEPAL, Simigaon, 3,050 m., X-30-1960, L. Swan. PALAU IS., Koror, III-24-1948, K. L. Maehler.

Variation in body lengths for 37 females 420μ to 505μ, mean 462μ with half of the individuals between 460μ and 470μ; males 345μ to 405μ, mean 382μ; deutonymphs 335μ to 425μ, mean 353μ; protonymphs 320μ to 360μ, mean 345μ; larva 225μ.

GEOGRAPHIC DISTRIBUTION. South China, East Himalayas.

HOST DISTRIBUTION. *Ophrygonius cantori* Percheron.

DISCUSSION. This species is similar to *H. exiguus* in having two pairs of setae on coxae III and in the position of setae D and P of tarsus IV. *Heterocheylus maai* is easily distinguished by the wider propodosoma and the shorter setae of genu III and IV. The species is named in honor of the collector of the type series.

Heterocheylus parvus Schuster and Lavoipierre, new species.
(Figure 9D.)

FEMALE(Holotype). Body 360μ long, 135μ wide. Palpal genual seta extending to apex of palp. Propodosoma 85μ long, 85μ wide; lateral setae 5μ, median setae 10μ; ampullae spherical, 6μ in diameter, separated by 32μ between centers. Metapodosoma with 2 pairs of setae 8μ; humeral setae 88μ. Intercalary segment with setae IM 91μ, Im 9μ, located anterior and slightly mesad to IM. Suranal setae Sl 71μ, Sm 61μ. Anal valves with setae Al 45μ, Am 34μ. Paragenital setae 9μ. Coxae III with 2 pairs of setae. Tarsus III with 6 setae; tarsus IV with 4 setae, setae D and P in distal half, inserted at the same level.

TYPE SERIES. The holotype female CAS 10,384, 5 female and 1 deutonymph paratypes are from CEYLON, *Leptaulax bicolor* Fabricius, Koebele.

GEOGRAPHIC DISTRIBUTION. Ceylon.

HOST DISTRIBUTION. *Leptaulax bicolor* Fabricius.

DISCUSSION. This species is distinguished by the very small, spherical ampullae.

Heterocheylus lombardinii Womersley.
(Figures 1A, 10A - F, 11A - D.)

This species is redescribed so that salient features are easily comparable to the other species. The type (not examined) was collected at QUEENSLAND, Mt. Lamington, *Mastochilus* sp., and is in the South Australian Museum. The redescription is of a female from Gwydir Hwy., New South Wales.

FEMALE. Body 645μ long, 260μ wide; palp tarsus with inner ramus conspicuously sclerotized; longer setae capitate. Palpal genual seta extending to apex of palp. Propodosomal dorsum faintly longitudinally striate; lateral setae 12μ; median setae 15μ; ampullae 16μ long, 20μ wide, their inner margins essentially contiguous. Metapodosoma with 2 pairs of setae 13μ; humeral setae 160μ. Intercalary segment with IM 145μ, Im 12μ, located anterior to IM. Suranal segment with Sl 140μ, Sm 120μ. Anal valves with setae Al 90μ, Am 77μ. Paragenital setae 14μ. Coxae III with 2 pairs of setae. Tarsus III with 6 setae; tarsus IV with 4 setae in distal half.

MALE. Body 425μ long, 190μ wide; all setae accuminate. Propodosoma with a pair of posterior discal setae 90μ. Lengths of posterior setae IM 115μ, Im 6μ; Sl 80μ, Sm 77μ; Al 45μ, and Am 40μ.

MEASUREMENTS. Body lengths of 17 females varied between 570μ and 675μ, mean 633μ; 6 males 420μ to 470μ, mean 422μ; 12 deutonymphs 353μ to 617μ, mean 524μ.

GEOGRAPHIC DISTRIBUTION. AUSTRALIA, New South Wales, Ulang, *Mastochilus australasicus* Percheron, II-1948, J. R. Slevin; Hampton Blue Mts., *Pharochilus nitidulus* MacLeay, I-(19-23)-1948, J. R. Slevin; Richmond River, *Mastochilus australasicus;* Lismore, *Mastochilus australasicus,*Deuquet; Gwydir Hwy., east side Gibraltar Range, 450 m., XI-28-1962, E. S. Ross, D. Q. Cavagnaro. QUEENSLAND, Curtis Falls, Mt. Tambourine, 400 m., XI-26-1962, E. S. Ross, D. Q. Cavagnaro; Paluma, 885 m., XI-11-1962, E. S. Ross, D. Q. Cavagnaro; 11 km. northeast Ravenshoe, 975 m.,XI-7-1962, E. S. Ross, D. Q. Cavagnaro; N. Queensland, Cairns, H. Peters.

HOST DISTRIBUTION. *Mastochilus australasicus* Percheron, *Pharochilus nitidulus* MacLeay.

DISCUSSION. The females of this species are distinguished by the approximate to contiguous ampullae and the males by their body size in excess of 400μ. The large size and similarity in palpal tibia-tarsus relate this species to *H. nixus*.

Heterocheylus nixus Schuster and Lavoipierre, new species.
(Figures 11E - H.)

FEMALE (Holotype). Body 570μ long, 220μ wide; scuta faintly micropunctate. Genual setae of palps not extending beyond apex of palps. Propodosoma 126μ long, 152μ wide; lateral setae 8μ, median setae 15μ; with a minute pore near each median seta; ampullae 20μ long, 17μ wide, separated by 47μ between centers. Metapodosoma with 2 pairs of setae about 9μ; humeral setae 148μ. Intercalary segment with seta IM 118μ, Im 12μ located anterior and slightly median to IM. Suranal setae Sl 124μ, Sm 109μ. Anal valves with setae Al 84μ, Am 65μ. Paragenital setae 12μ. Coxae III with 2 pairs of setae. Tarsus III with 6 setae; tarsus IV with 4 setae.

MALE. Body 445μ long, 160μ wide, propodosoma with discal setae 110μ, humeral setae 125μ.

TYPE SERIES. The holotype female CAS 10,385, and 1 paratype female from PHILLIPPINES, Mindoro, San Jose, *Labiens ptox* Kaup, X-1945, E. S. Ross. One paratype male, one female, NEW GUINEA, Maffin Bay, *Labiens ptox,* VII-4-1944, E. S. Ross. Two additional female examples collected at NEW GUINEA, Finschhafen, on *Protomocoelus australis* Boisduval, are similar, except for the structure of tarsus II,and may belong to this species.

GEOGRAPHIC DISTRIBUTION. Philippines and New Guinea.

HOST DISTRIBUTION. *Labiens ptox* Kaup and *Protomocoelus australis* Boisduval.

DISCUSSION. The elongate tarsi and the long, thin claw of tarsus II usually distinguish the females of this species. The character of the palpal tibia-tarsus provides a more exacting although difficult means of identifying this species. Similarity in palp tarsal structure and in the shape of the pedal tarsi aid in associating the male sex. None of the immature stages are known.

Heterocheylus incohatus Schuster and Lavoipierre, new species.
(Figure 12A.)

FEMALE (Holotype). Body 335μ long, 128μ wide. Palpal genual setae extending slightly beyond apex of palp. Propodosoma smooth, 71μ long, 90μ wide; lateral setae 4μ, median setae 8μ; ampullae 9μ long, 6μ wide, separated by 42μ between centers. Metapodosoma with 2 pairs of setae about 6μ; humeral setae 101μ. Intercalary segment with setae IM 75μ, Im 5μ, located anterior to IM. Suranal setae Sl 56μ, Sm 8μ. Anal valves with setae Al 20μ, Am 20μ. Paragenital setae 8μ. Coxae II with 2 pairs of setae; coxae III with 2 pairs of setae. Tarsus III with 6 setae; tarsus IV with 5 setae, a small basal posterior seta present.

One female gravid, the egg 30μ in diameter, and one larva 185μ. The male and nymphal stages unknown.

TYPE SERIES. Holotype female, CAS 10,386, AUSTRALIA, Queensland, Paluma, 900 m., unidentified passalid, XI-11-1962,E. S. Ross, D. Q. Cavagnaro. The following specimens are paratypes: 2 females, Queensland, Malanda, 700 m., XI-8-1962, E. S. Ross, D. Q. Cavagnaro; 2 females,North Queensland, *Aulacocyclus errens* Blackburn, H. Peters; 2 females,Northern Territory, Port Darwin, *Aulacocyclus rosenbergi* Kaup, Deuquet. Two females, 1 larva, SOLOMON ISLANDS, Florida Island, *Aulacocyclus papuanus* Heller, 1944, H. P. Chandler.

GEOGRAPHIC DISTRIBUTION. Australia, Queensland, Northern Territory, Solomon Islands.

HOST DISTRIBUTION. *Aulacocyclus errens* Blackburn, *A. rosenbergi* Kaup, *A. papuanus* Heller.

DISCUSSION. The small size, occurrence of two pairs of setae on coxae I, and the greatly reduced setae Sm characterize this species.

Heterocheylus becki Schuster and Lavoipierre, new species.
(Figures 12B - C, F.)

FEMALE (Holotype). Body 315μ long, 120μ wide. Genual seta of palp not extending to apex of palp. Propodosoma smooth, 70μ long, 72μ wide; lateral setae 5μ, median setae 8μ; ampullae elongate, distal margin subtruncate, 18μ long, 7μ wide, separated by 28μ between centers. Metapodosoma with 2 pairs of setae 9μ; humeral setae 94μ. Intercalary segment with setae IM 75μ, Im 8μ, located anterior to IM. Suranal setae Sl 65μ, Sm 60μ. Anal valves with setae Al 43μ, Am 30μ. Paragenital setae 9μ. Coxae III with 2 pairs of setae. Tarsus III with 6 setae; tarsus IV with 4.

MALE AND IMMATURE STAGES. Unknown.

TYPE SERIES. Holotype female UCD 317 and 2 paratype females MALAYSIA, 8 km. north Karak Puhang, undetermined passalid, XI-23-1965, A.J. Beck.

GEOGRAPHIC DISTRIBUTION. Known from the type locality in Malaysia.

HOST DISTRIBUTION. Unidentified passalid beetles, subfamily Macrolininae.

DISCUSSION. Among the other small species occurring in Southeast Asia, this species is easily recognized by the flattened ampullae which are at least twice as long as wide and with subtruncate distal margins. This species is named for Dr. Albert J. Beck whose collection of this new species was responsible for our further inquiry into the species of Heterocheylidae.

Heterocheylus novellus Schuster and Lavoipierre, new species.
(Figures 12D, E.)

FEMALE (Holotype). Body 360μ long, 128μ wide, propodosoma weakly striate laterally, hysterosoma plicate and micropunctate. Palpal genual setae not extending to apex of palps. Propodosoma 83μ long, 72μ wide; lateral setae 5μ, median setae 8μ; ampullae elongate with distal margin rounded, 15μ long, 6μ wide, separated by 32μ between centers. Metapodosoma with 2 pairs of setae 6μ; humeral setae 122μ. Intercalary segment with seta IM 96μ, Im 6μ, located anterior and slightly median to IM. Suranal setae Sl 80μ, Sm 68μ. Anal valves with setae Al 48μ, Am 35μ. Paragenital setae 8μ. Coxae III with 2 pairs of setae. Tarsus III with 6 setae; tarsus IV with 4 setae all in distal half.

MALE. Body 269μ long, 92μ wide; propodosoma 55μ long, 55μ wide, with a pair of discal setae 59μ; humeral setae 65μ.

IMMATURES. Four protonymphs 255μ to 290μ, the individual of 290μ moulting, one deutonymph 330μ long.

TYPE SERIES. Holotype female CAS 10,387, 8 paratype females, 1 male, 1 deutonymph and 4 protonymphs from PHILIPPINES, Laguna, Mt. Makiling, *Trichostigmus thoreyi* Kaup, V-1-1931, F. C. Hadden. Additional paratypes are 2 females, 2 males, and 1 moulting protonymph from the same passalid species, Agricultural College, Laguna, VI-1-1931, F. C. Hadden.

Eleven females are between 336μ and 355μ. Four protonymphs are 255μ to 270μ with an additional moulting individual 290μ. A single deutonymph is 330μ.

GEOGRAPHIC DISTRIBUTION. Philippines.

HOST DISTRIBUTION. *Trichostigmus thoreyi* Kaup.

DISCUSSION. This species is most closely related to *H. becki*. The ampullae of *H. novellus* are widest at the middle and rounded distally, while those of *H. becki* are widest at or near the apex with the margin subtruncate.

KEY TO NORTH AND SOUTH AMERICAN *HETEROCHEYLUS* FEMALES

1. Tarsus IV with 4 setae, without a small basal posterior seta (fig. 14D)..3
Tarsus IV with 5 setae, a small basal posterior seta present (figs. 13B, C)..2

2(1). Coxae I with 1 pair of setae..........................*H. laui*
Coxae I with 2 pairs of setae..........................*H. minus*

3(1). Tarsus IV with seta D located near middle or distinctly in distal one-half (fig. 15B); seta Im anterior to IM (fig. 15A, detail)..........................*H. proximus*
Tarsus IV with seta D distinctly located in basal half (fig. 14D); seta Im mesad to IM so the 2 pairs of setae Im and IM form transverse row (fig. 14A)..........................4

4(3). Large species, 450μ to 600μ; on *Passalus interstitialis*...*H. keiferi*
Small species, 300μ to 450μ; on *Paxillus leachi*...*H. transversus*

Heterocheylus laui Schuster and Lavoipierre, new species.
(Figures 13A - B, D.)

FEMALE (Holotype). Body 430μ long, 192μ wide. Palpal genual seta extending slightly beyond apex of palp. Propodosoma 98μ long, 109μ wide, weakly striate laterally; lateral setae 7μ, median setae 11μ; ampullae 14μ long, 8μ wide, separated by 46μ between centers. Metapodosoma with 2 pairs of setae 10μ; humeral setae 144μ. Intercalary segment with setae IM 164μ, Im 11μ, located mesad to IM. Suranal setae Sl 172μ, Sm 146μ. Anal valves with setae Al 112μ, Am 61μ. Paragenital setae 12μ. Coxae I with 1 pair of setae; coxae III with 2 pairs of setae. Tarsus III with 6 setae; tarsus IV with 5 setae, a minute posterior seta present near base of segment.

MALE. Body 360μ long, 150μ wide; propodosoma 85μ long, 100μ wide; with a pair of discal setae 100μ; humeral setae 100μ.

TYPE SERIES. The holotype female UCD 318, 3 female, 3 male, 1 deutonymph, 1 protonymph paratypes. MEXICO, Veracruz, Cordoba, X-20-1966, A. B. Lau, and VII-1-1966, J. S. Buckett, M. R. Gardner and R. C. Gardner. Additional paratypes are as follows: MEXICO, 2 females,Orizaba, *Passalus punctostriatus* Percheron; 1 female,Chiapas, 16 km. northwest Comitan, VIII-9-1963, F. D. Parker, L. A. Stange. GUATEMALA, 1 female, Suchetepeque, Finca El Cipres, 910 m., *Passalus punctostriatus*, June, 1926. PANAMA, 1 female,Potrerillas, *Passalus spiniger* Bates, I-25-1935, J. W. MacSwain. HONDURAS, 1 female, 1 deutonymph, 150 m. up Patuca Rio, *Passalus punctostriatus*, V-12-1947, C. W. Cook.

GEOGRAPHIC DISTRIBUTION. Mexico, Panama, Guatemala, Honduras.

HOST DISTRIBUTION. *Passalus punctostriatus* Percheron, *P. spiniger* Bates.

DISCUSSION. Of the American species, only *H. laui* and *H. minus* have five setae on tarsus IV. This species is easily distinguished by setae Sm being of normal length, while those of *H. minus* are greatly reduced. Ten females vary in length between 370μ and 437μ, mean 418μ. The protonymph of this species has a macroseta on tibia IV.

Heterocheylus minus Schuster and Lavoipierre, new species.
(Figures 13C, E.)

FEMALE (Holotype). Body 385μ long, 158μ wide, integument smooth. Palpal genual seta not extending beyong apex of palp. Propodosoma 94μ long, 105μ wide; lateral setae 8μ, median setae 13μ; ampullae 12μ long, 8μ wide, separated by 44μ between centers. Metapodosoma with 2 pairs of setae 8μ, humeral setae 135μ. Intercalary segment with setae IM 109μ; Im 8μ, located anterior to IM. Suranal setae Sl 78μ, Sm 22μ. Anal valves with setae Al 50μ, Am 32μ. Paragenital setae 9μ. Coxae I with 2 pairs of setae; coxae III with 2 pairs of setae. Tarsus III with 6 setae; tarsus IV with 5 setae.

MALE AND DEUTONYMPH. Unknown. The protonymph is of the normal type, tibia IV lacking setae.

TYPE SERIES. The holotype female CAS 10,388, and 1 paratype female from PANAMA, Chirigui Prov., Bogueta, *Passalus caelatus* Erichson,I-15-1932, M. E. McLelland. Other paratypes are from MEXICO, 1 female, 1 protonymph, 1 larva, Veracruz, 11 km. southeast Las Viges, XII-18-1948, H. B. Leech.

GEOGRAPHIC DISTRIBUTION. Panama, Mexico.

HOST DISTRIBUTION. *Passalus caelatus* Erichson.

DISCUSSION. This species, by nature of the two pairs of setae on coxae I, and by the reduced opisthosomal setae, is unrelated to any other American species. It is close to *H. incohatus*, an Australian species, differing from that species by the lengths of most setae (see figs. 12A and 13E).

Heterocheylus keiferi Schuster and Lavoipierre, new species.

(Figures 1C, 14A-C, E.)

FEMALE (Holotype). Body 571μ long, 248μ wide, propodosoma deeply sculptured basolaterally. Palpal genual seta extending beyond apex of palp. Propodosomal dorsum 120μ long, 160μ wide; lateral setae 14μ, median setae 17μ; ampullae 17μ long, 11μ wide, separated by 63μ between centers. Metapodosoma with 2 pairs of setae 14μ; humeral setae 228μ. Intercalary segment with IM 194μ, Im 14μ, located mesad to IM. Suranal setae Sl 164μ, Sm 156μ. Anal valves with setae Al 135μ, Am 114μ. Paragenital setae 20μ. Coxae I with 1 pair of setae, coxae III with 2 pairs. Tarsus III with 6 setae; tarsus IV with 4 setae, with seta D basal, distinctly distant from seta P.

MALE. Body 538μ long, 245μ wide; propodosoma 105μ long, 160μ wide with a pair of discal setae 135μ; humeral setae 150μ.

IMMATURES. Two larvae identified as this species are 270μ and 300μ long. Protonymphs examined varied between 350μ and 400μ. Tibia IV has one long seta but the three short setae are absent. The anal valves are not as elongate as those of the deutonymph. Deutonymphs range in length from slightly over 400μ to about 600μ. The anal valves (fig. 14C) are elongate and setae Al and Am are longer than those of the protonymph. The presence of one seta on tibia IV is common to three species, *H. laui*, *H. keiferi*, and *H. transversus*.

TYPE SERIES. Holotype female CAS 10,389, 11 female, 2 male, 2 deutonymph, 1 protonymph paratypes. MEXICO, Tres Marias Islands, Maria Madre Island, Arroyo Hondo, *Passalus interstitialis* Eschscholtz and *Passalus punctiger* St. Fargeau and Serville, V-17-1925, H. H. Keifer. The 12 females from this locality are between 504μ and 594μ with a mean of 558μ. The type is the best preparation within 15μ of the mean length. Additional paratypes include specimens from the following localities: MEXICO, 3 females, Sinaloa, Venedio, VI-27-1918; 19 females, 1 male, 2 protonymphs, Veracruz, 5 km. south Santa Rosa, VIII-17-1959, L. A. Stange, A. S. Menke; 1 female, 1 deutonymph, Puebla, 32 km. northeast Villa A. Comacho, XII-28-1963, C. W. O'Brien; 2 females, 2 males, 2 protonymphs, Veracruz, Fortinde las Flores, XII-23-1963, L. B. and C. W. O'Brien; 2 females, Paso de Ovejas, IV-30-1962, F. D. Parker, L. A. Stange; Nayarit, 2 deutonymphs, San Blas, *Passalus interstitialis*, IX-17 to 21-1953, B. Malkin. GUATEMALA, 7 females, 1 male, Nuevo Concepcion, 13 m., VIII-17-1963, D. Q. Cavagnaro, M. E. Irwin. HONDURAS, 1 female, 2 males, 1 deutonymph, Jamastran, V-25-1964, G. A. Axtel; 1 female, 1 deutonymph, 1 protonymph, Patuca Bar, 50 m., Brus Lagoon, IV-11-1947, C. W. Cook; 1 male, La Ceiba, *Passalus punctiger*, XII-21-1940, C. C. Cook. EL SALVADOR, 1 female, La Libertad, *Passalus punctiger*, V-14-1951, E. S. Ross; 2 females, Quezaltepeque, and 5 km. north, VI-29 and VIII-1-1961, M. E. Irwin. PANAMA, 9 females, 2 males, La Chorrera, *Passalus interstitialis*, V-23-1944, K. E. Frick. CANAL ZONE, 1 female, 1 male, 1 deutonymph, Madden Dam, *Passalus interstitialis*, VI-1936, M. M. Saylor;

7 females, 3 males, 9 deutonymphs, Barro Colorado Isl., VII-24-1963, D. Q. Cavagnaro, M. E. Irwin. COLOMBIA, 1 female, 28 km. southeast Mocoa Narino, 510 m., *Passalus coniferus* Eschscholtz, III-2-1955, E. I. Schlinger, E. S. Ross; 1 female, Santa Marta, XII-1958. PERU, 7 females, 2 males, 2 deutonymphs, Monson Valley, Tingo Maria, *Passalus punctiger*, X and XI-1954, E. I. Schlinger, E. S. Ross; 1 female, 2 deutonymphs, same locality, *Passalus interstitialis;* 1 female, 2 males, 2 deutonymphs, same locality, *Passalus coniferus*, XII-12-1954. BOLIVIA, 4 females, El Montero, 70 km. north Santa Cruz, V-7-1964, E. S. Ross. ARGENTINA, 2 females, 2 deutonymphs, Salta Prov., *Passalus punctiger*, X,XI-1933, W. C. Harington; 1 female, 1 deutonymph, El Quemado Prov., Jujuy, *Passalus punctiger*, I-19-1925, G. L. Harrington. TRINIDAD, 1 female *Passalus interstitialis*, III-9-1929, H. S. Parish. VENEZUELA, 7 females, 1 male, 13 deutonymphs, Guanare estado, *Passalus interstitialis*, IX-10 to 13, 1957, B. Malkin. BRAZIL, 4 females, Amapa, Villa Amazonas, III-21-1964, C. E. Ross, E. S. Ross; 1 female, Santa Caterina, Nova Teutonia, 300 m., IV-19-1964, C. E. and E. S. Ross; 1 female, Foz do Iguacu, Parana, IV-25-1964, C. E. and E. S. Ross.

Specimens thought to belong to this species, but differing in some respect are from: PANAMA, CANAL ZONE, Barro Colorado Island. BRAZIL, Perana, Campo Largo; Rio Jeneirn; Posto Alpino, 65 km. northeast Curitiba.

GEOGRAPHICAL DISTRIBUTION. This species is widespread in North America and in South America between 25° north and 25° south latitudes.

HOST DISTRIBUTION. *Passalus interstitialis* Eschscholtz, *P. punctiger* St. Fargeau and Serville and *P. coniferus* Eschscholtz.

DISCUSSION. This species is similar to *H. transversus* except for size. *H. keiferi* is distinguished by a body length of between 480μ and 600μ. The setae of the palpal genua extend beyond the apex of the palp. Seta Im is mesad and not anterior to IM, and seta D is located near the proximal margin of the tarsus, far removed from seta P. Seta IM is the longest opisthosomal seta of *H. keiferi*, while suranal seta Sl is the longest seta of the opisthosoma of *H. transversus*.

Heterocheylus transversus Schuster and Lavoipierre, new species.
(Figures 14D, F.)

FEMALE (Holotype). Body 370μ long, 158μ wide; propodosoma reticulate in basal lateral areas. Genual setae of palps thick, distinctly extending beyond palps. Propodosoma 82μ long, 95μ wide; lateral setae 5μ, median setae 13μ; ampullae 13μ long, 9μ wide, separated by 38μ between centers. Metapodosoma with 2 pairs of setae 8μ; humeral setae 112μ. Intercalary segment with setae IM 121μ, Im 8μ, located mesad of IM. Suranal setae Sl 135μ, setae Sm 95μ. Anal valves with setae Al 95μ, Am 84μ. Paragenital setae 13μ. Coxae III with 2 pairs of setae. Tarsus III with 6 setae; tarsus IV with 4 setae, seta D widely separated from P, with setae D in basal half.

MALE. Body 340μ long, 150μ wide. Propodosoma 85μ long, 110μ wide, with pair of discal setae 70μ; humeral setae 100μ.

TYPE SERIES. The holotype female CAS 10,390, 8 female, 2 male, 7 deutonymph, 5 protonymph, 1 larval paratypes from ECUADOR, Pichilinque, Los Rios, *Paxillus leachi* MacLeay, II-2-1955, E. I. Schlinger, E. S. Ross. Additional specimens considered to be this species but not included in the paratype series are from: PANAMA, CANAL ZONE, 1 female, Barro Colorado Island, *Paxillus leachi*,XI-22-1944, K. E. Frick.

BRAZIL, 4 females, 2 males, 2 deutonymphs, 2 protonymphs, Villa Amazonas, Amapa, V-29-1964, E. S. Ross and C. E. Ross; 5 females, 1 male, 1 deutonymph, Paranda, Foz do Iĝuaçu, IV-25-1964, C. E. and E. S. Ross; 6 females, 3 males, Rio de Janeiro, Paineras, III-29-1964, C. E. Ross, E. S. Ross.

GEOGRAPHIC DISTRIBUTION. Brazil, Ecuador, Panama Canal Zone.

HOST DISTRIBUTION. *Paxillus leachi* MacLeay.

DISCUSSION. This species is closely related to *H. keiferi*, differing mainly in size. *H. transversus* females vary between 350μ and 450μ, while the range for *H. keiferi* females is between 450μ and 600μ.

Heterocheylus proximus Schuster and Lavoipierre, new species.
(Figures 15A-D.)

FEMALE (Holotype). Body 410μ long, 155μ wide. Palpal genual seta not extending to apex of palp. Propodosoma weakly striate laterally, 100μ long, 92μ wide; lateral setae 5μ, median setae 9μ; ampullae 11μ long, 9μ wide, separated by 35μ between centers. Metapodosoma with 2 pairs of setae 9μ; humeral setae 143μ. Intercalary segment with setae IM 119μ, Im 8μ, located anterior and slightly mesad of IM. Suranal setae Sl 98μ, Sm 90μ. Anal valves with setae Al 67μ, Am 46μ. Paragenital setae 11μ. Coxae III with 2 pairs of setae. Tarsus III with 6 setae; tarsus IV with 4 setae. Seta D of tarsus IV located in distal half, close to seta P.

MALE. Body 339μ long, 125μ wide. Propodosoma 77μ long, 124μ wide, with a pair of discal setae 93μ, humeral setae 119μ.

TYPE SERIES. The holotype female CAS 10,391, 5 female and 2 male paratypes from BRAZIL, Posta Alpino, 65 km. northeast Curitiba, IV-14-1964, C. E. Ross, E. S. Ross. This species occurs in both North and South America. It was recovered from a number of passalid species, exhibits slight variability between localities, and may eventually be recognized as consisting of many subspecific taxa. Specimens considered to be *H. proximus* are from: BRAZIL, 2 females, Belém, III-17-1964, C. E. Ross, E. S. Ross; 5 females, 1 deutonymph, Caraca, Minas Gerais, *Passalus plicatus* Percheron; 1 female, Curitiba, *Passalus anguliferus* Percheron; 1 male, 3 protonymphs, Mato Grosso, Barra do Tapirape, XII-11-1962, B. Malkin; 2 females, 4 deutonymphs, Nova Teutonia, 300 m., IV-19-1964, C. E. Ross, E. S. Ross; 1 female, Rio de Janeiro, *Passalus morio latifrons* Percheron, D. Davis; 1 male, 2 deutonymphs, Vicosa, Mines-erens, *Passalus interstitialis* Eschscholtz, Y. Mexia; 1 female, 5 males, 3 deutonymphs, Vilavelha Park, Parana, IV-13-1964, C. E. Ross, E. S. Ross. PERU, 6 females, 2 males, 2 protonymphs, east side Carpish Mtns., 64 km. southwest Tingo Maria, 2,800 m., *Passalus caelatus* Erichson, X-17-1954, E. I. Schlinger, E. S. Ross; 1 female, Colonia Perene, Rio Perene, 29 km. northeast La Merced, *Passalus spinifer* Bates, VI-1, 3-1955, E. I. Schlinger, E. S. Ross. BOLIVIA, 3 females, 2 males, 3 deutonymphs, El Palmar, Yungas, *Paxillus pleuralis* Luederwaldt, IX, X-1948. COLOMBIA, 1 female, 10 km. west Cali Valle, 1,630 m., *P. interstitialis*, III-20-1955, E. I. Schlinger, E. S. Ross. CANAL ZONE, 4 deutonymphs, Barro Colorado Is., VII-24-1963 D. Q. Cavagnaro, M. E. Irwin; 1 female, 1 deutonymph, Fort Clayton, *Popilius tau* Kaup, V-1944, K. E. Frick. GUATEMALA, 2 females, 1 deutonymph, 1 protonymph, Finca El Cipres, Suchetepeque, 912 m., *Popilius striatopunctatus* Percheron, J. R. Slevin. MEXICO, 9 females, 2 males, 1 deutonymph, 42 km. east Ciudad del Maíz, San Luis Potosí, XI-19-1948, E. S. Ross; 4 females, 2 males, Tamazunchale, San Luis Potosí, *P. striatopunctatus*, V-28-1941, R. W. L. Potts; 3 females, 4 males, 2 deutonymphs, 3 protonymphs, 1 larva, Teopisca, Chiapas, IV-12-1962, L. A. Stange; 1 female, Temascal, Oaxaca, IX-6-1966, A. B. Lau. UNITED STATES, 4 females, 1 deutonymph, Mobile, Mobile Co., Alabama, *Popilius disjunctus* (Illinger), XII-1-1939; 1 female, Tuskegee, Macon Co., Alabama, D. C. Rentz, K. A. Rentz; 3 females, 1 deutonymph, Hot Springs Nat'l.Park, Garland Co., Arkansas, L. A. Stange; 1 female, 1 deutonymph, 1 protonymph, Nashville, Howard Co., Arkansas, *P. disjunctus*, K. E. Frick; 2 females, Sheldon, Connecticut, VII-2-1960, W. R. Nickle; 1 female, Fruitland Park, Lake Co., Florida, *P. disjunctus*, L. D. V. Smith; 3 females, 1 larva, Clayton, Rabun Co., Georgia, *P. disjunctus*, IV-11-1940; 7 females, 2 males, 3 deutonymphs, Fort Benning, Chattahoochee Co., Georgia, V-14 to VI-15-1943, A. Brereton; 1 female, 2 males, Lula, Hall Co., Georgia, D. C. Rentz, K. A. Rentz; 2 females, 1 deutonymph, Hillview, Greene Co., Illinois, VI-1928, A. T. McClay; 1 female, Park Co., Indiana, V-10-1958, N. M. Downie; 3 protonymphs, 3 larvae, Hazard, Perry Co., Kentucky, VII-16-1948, B. Watkins; 3 females, 1 male, Sparrows Point, Baltimore Co., Maryland, VII-8-1932, J. W. Green; 1 female, Duke Forest,Durham, Durham Co., North Carolina, A. Fenyes; 1 female, Latimer Co., Oklahoma, VII-20-1931; 2 females, Texas, XII-27-1964, B. Stevens; 1 female, Rock Creek Park, Washington, D. C., VI-13-1943.

GEOGRAPHICAL DISTRIBUTION. Brazil, Peru, Bolivia, Colombia, Canal Zone, Guatemala, Mexico, United States.

HOST DISTRIBUTION. *Passalus plicatus* Percheron, *P. morio latifrons* Percheron, *P. spinifer* Bates, *P. caelatus* Erichson, *P. anguliferus* Percheron, *Popilius striatopunctatus* Percheron, *P. disjunctus* (Illinger), *Paxillus pleuralis* Luederwaldt.

DISCUSSION. This species is distinguished by the genual seta of the palp not extending to the apex of the palp, by setae D and P of tarsus IV being in the distal half and located at the same level, and by seta Im being closely associated with IM and located anterior to IM.

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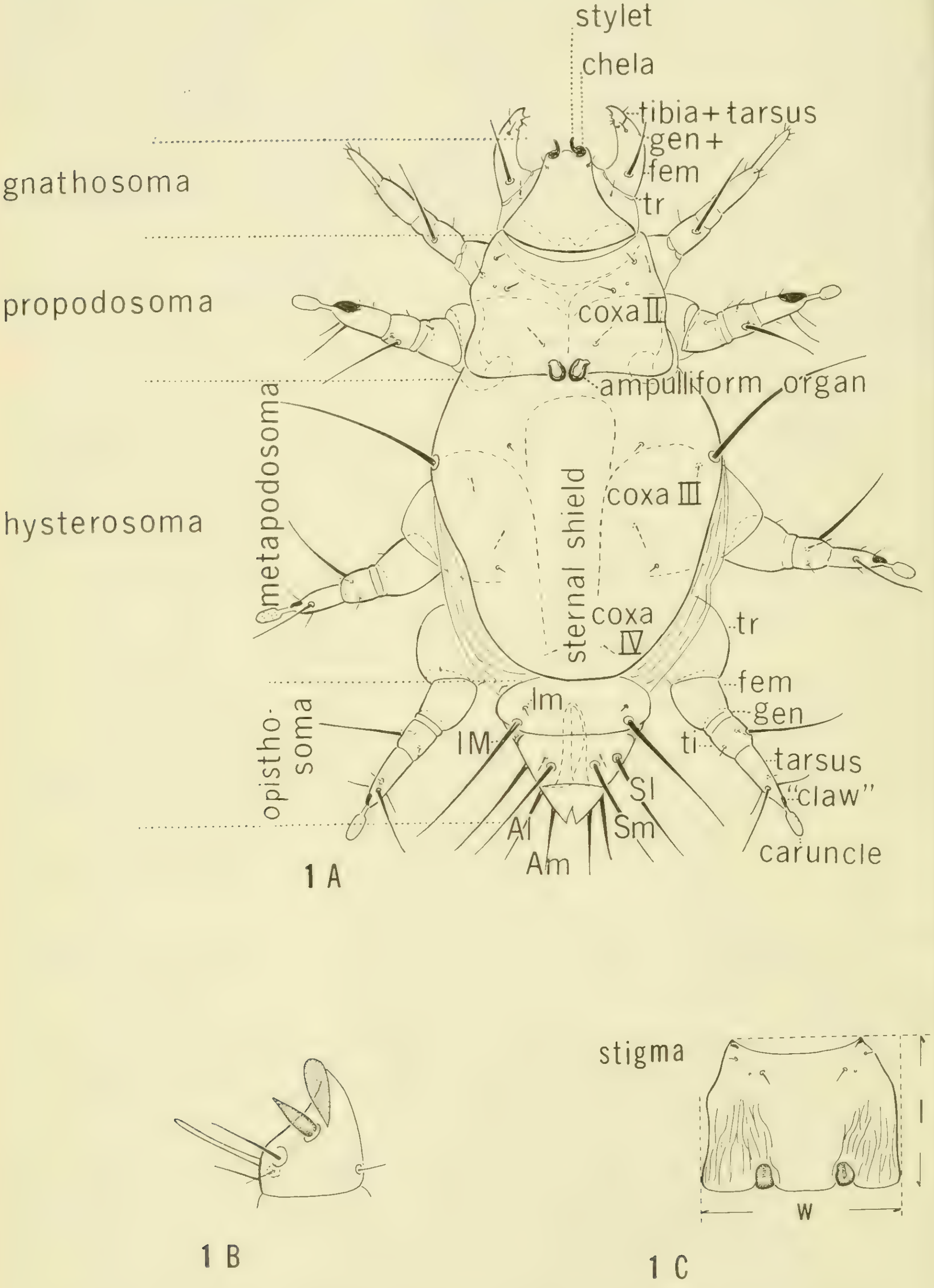

FIGURE 1. A. *Heterocheylus lombardinii* Womersley, female, dorsal view. B. *H. rossi*, new species, tibia-tarsus. C. *H. keiferi*, new species, propodosoma, dorsal view.

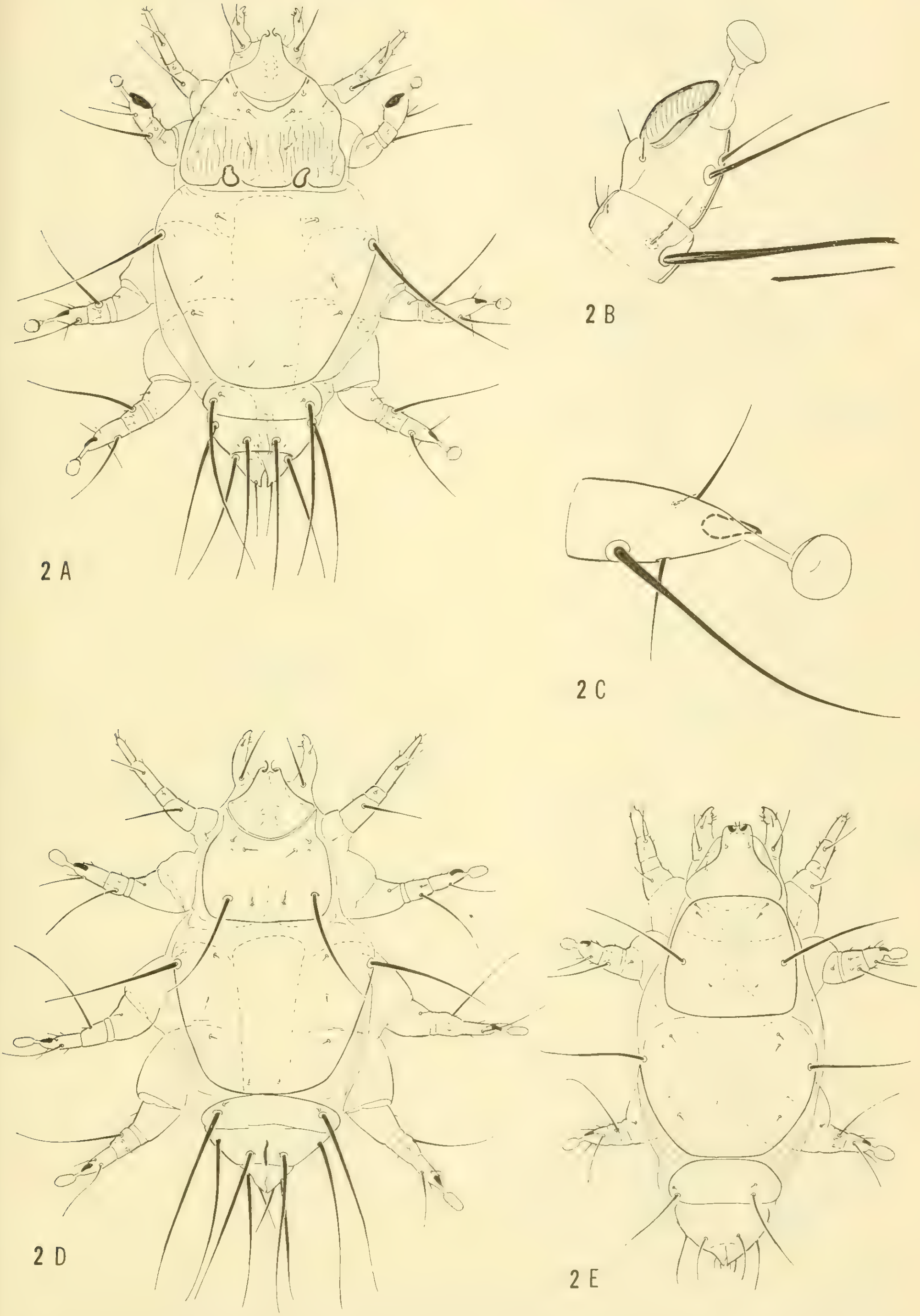

FIGURE 2. *Heterocheylus rossi*, new species. A. Female, dorsal view. B. Female, tarsus II. C. Female, tarsus IV. D. Male, dorsal view. E. Larva, dorsal view.

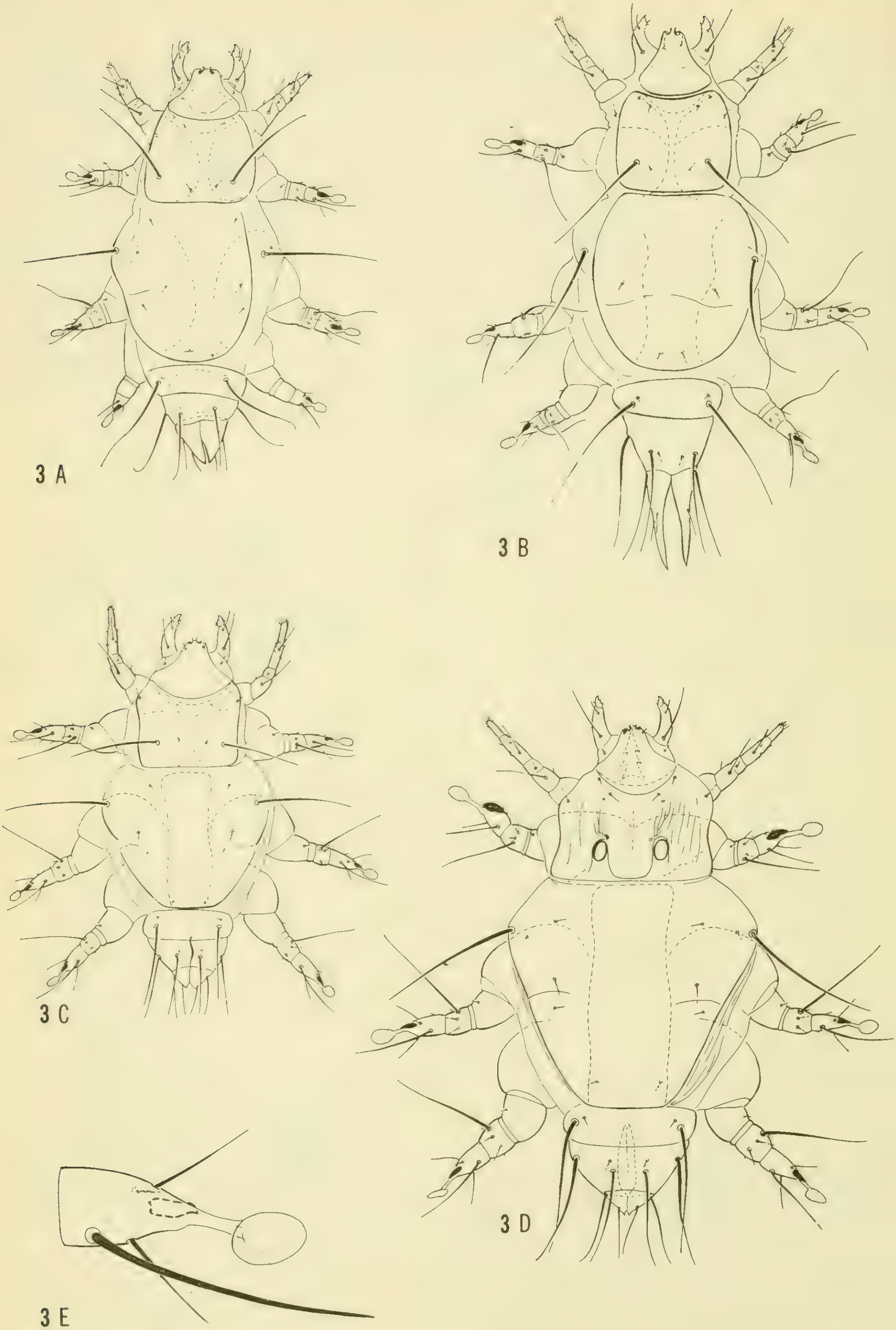

FIGURE 3. A. *Heterocheylus rossi,* new species, protonymph, dorsal view. B. *H. rossi,* new species, deutonymph, dorsal view. C. *H. recessus,* new species, male, dorsal view. D. *H. recessus,* new species, female, dorsal view. E. *H. recessus,* new species, female, tarsus IV.

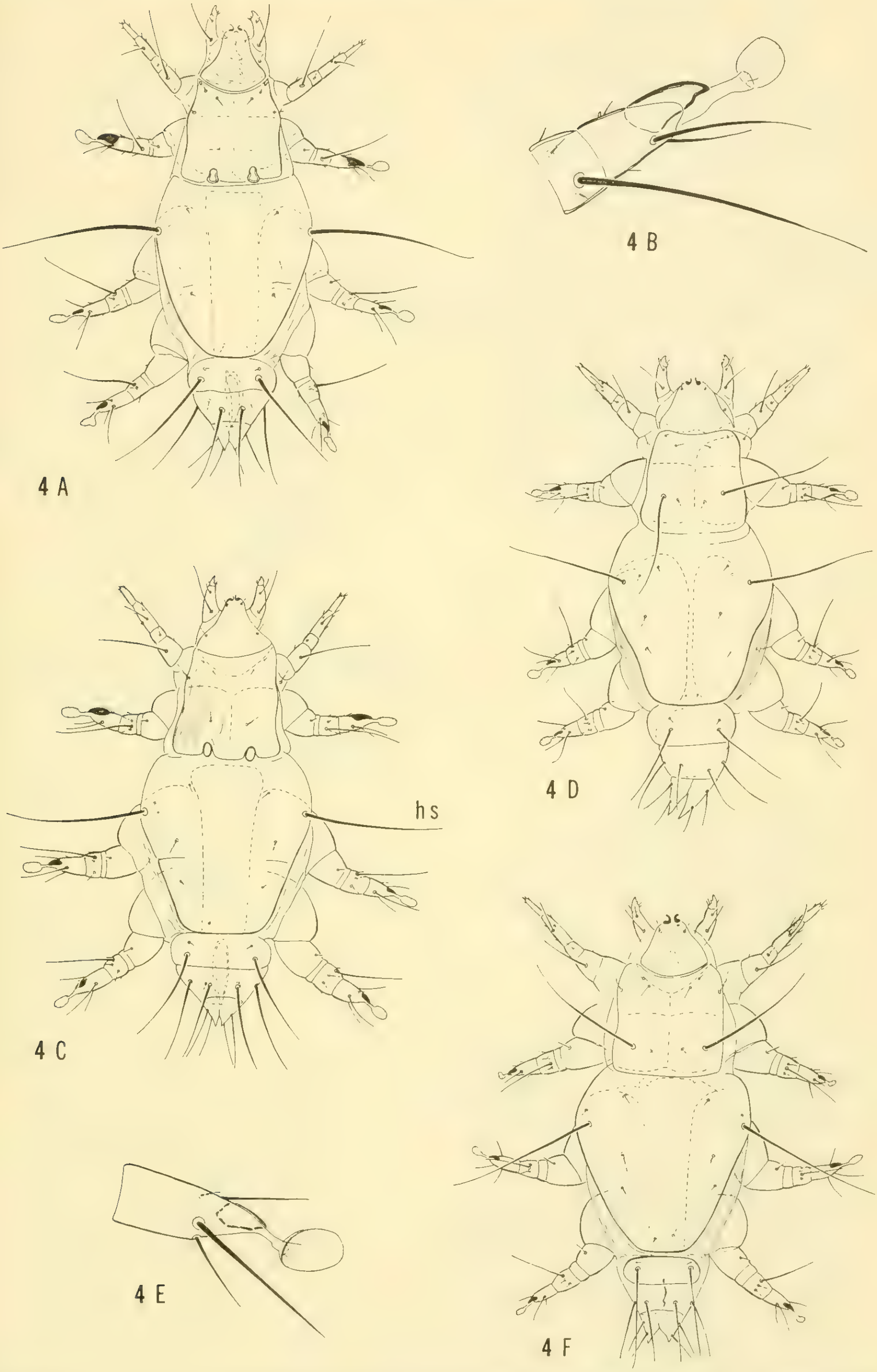

FIGURE 4. A. *Heterocheylus malkini*, new species, female, dorsal view. B. *H. malkini*, new species, female, tarsus II. C. *H. brevispinus*, new species, female, dorsal view. D. *H. brevispinus*, new species, deutonymph, dorsal view. E. *H. brevispinus*, new species, female, tarsus IV. F. *H. brevispinus*, new species, male, dorsal view.

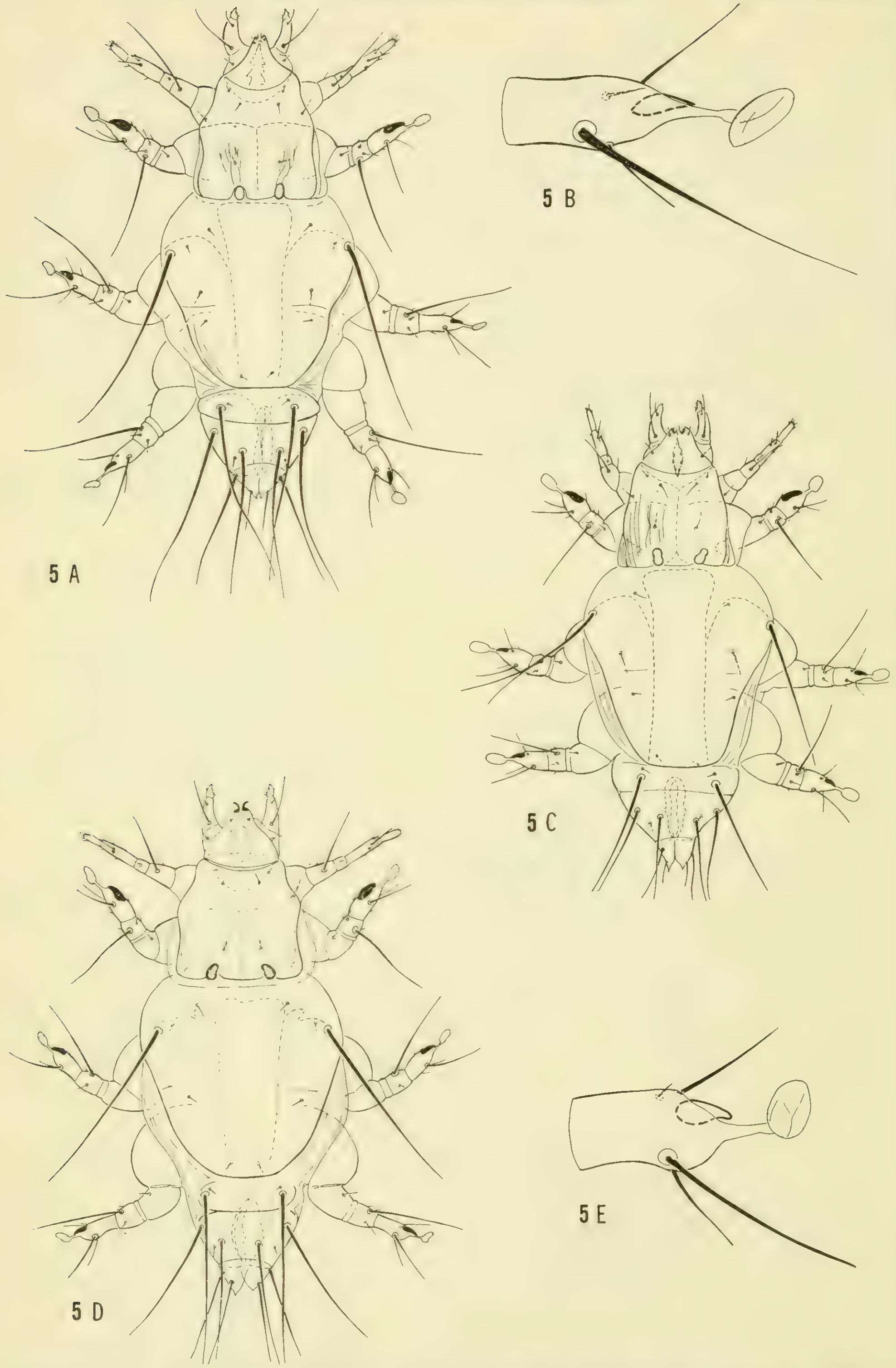

FIGURE 5. A. *Heterocheylus longispinosus*, new species, female, dorsal view. B. *H. longispinosus*, new species, female, tarsus. C. *H. thai*, new species, female, dorsal view. D. *H. propinquus*, new species, female, dorsal view. E. *H. propinquus*, new species, female, tarsus IV.

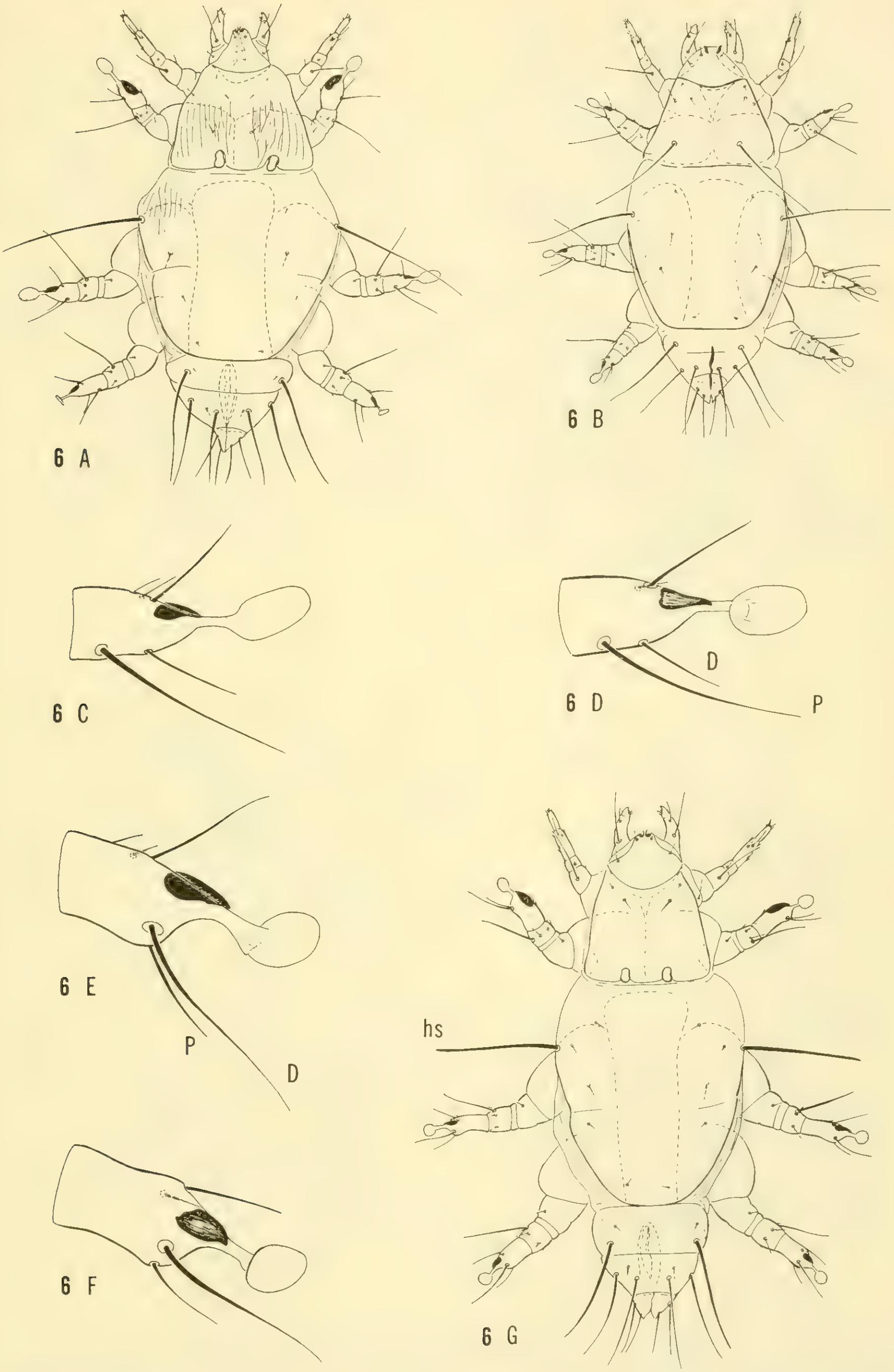

FIGURE 6. A. *Heterocheylus bengalensis,* new species, female, dorsal view. B. *H. bengalensis,* new species, male, dorsal view. C. *H. bengalensis,* new species, female, tarsus III. D. *H. bengalensis,* new species, female, tarsus IV. E. *H. indicus,* new species, female, tarsus III. F. *H. indicus,* new species, female, tarsus IV. G. *H. indicus,* new species, female, dorsal view.

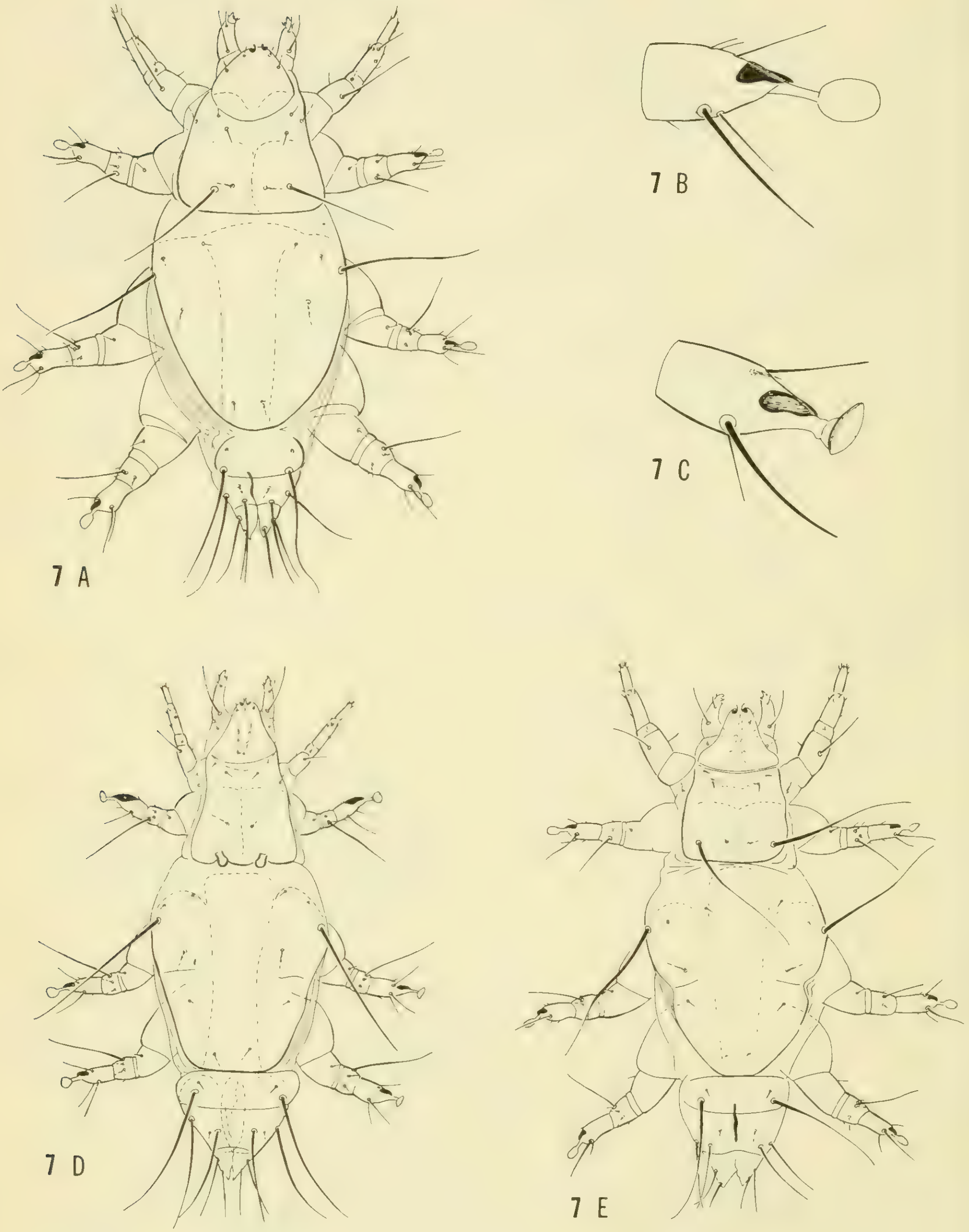

FIGURE 7. A. *Heterocheylus indicus*, new species, male, dorsal view. B. *H. exiguus*, new species, female, tarsus III. C. *H. exiguus*, new species, female, tarsus IV. D. *H. exiguus*, new species, female, dorsal view. E. *H. exiguus*, new species, male, dorsal view.

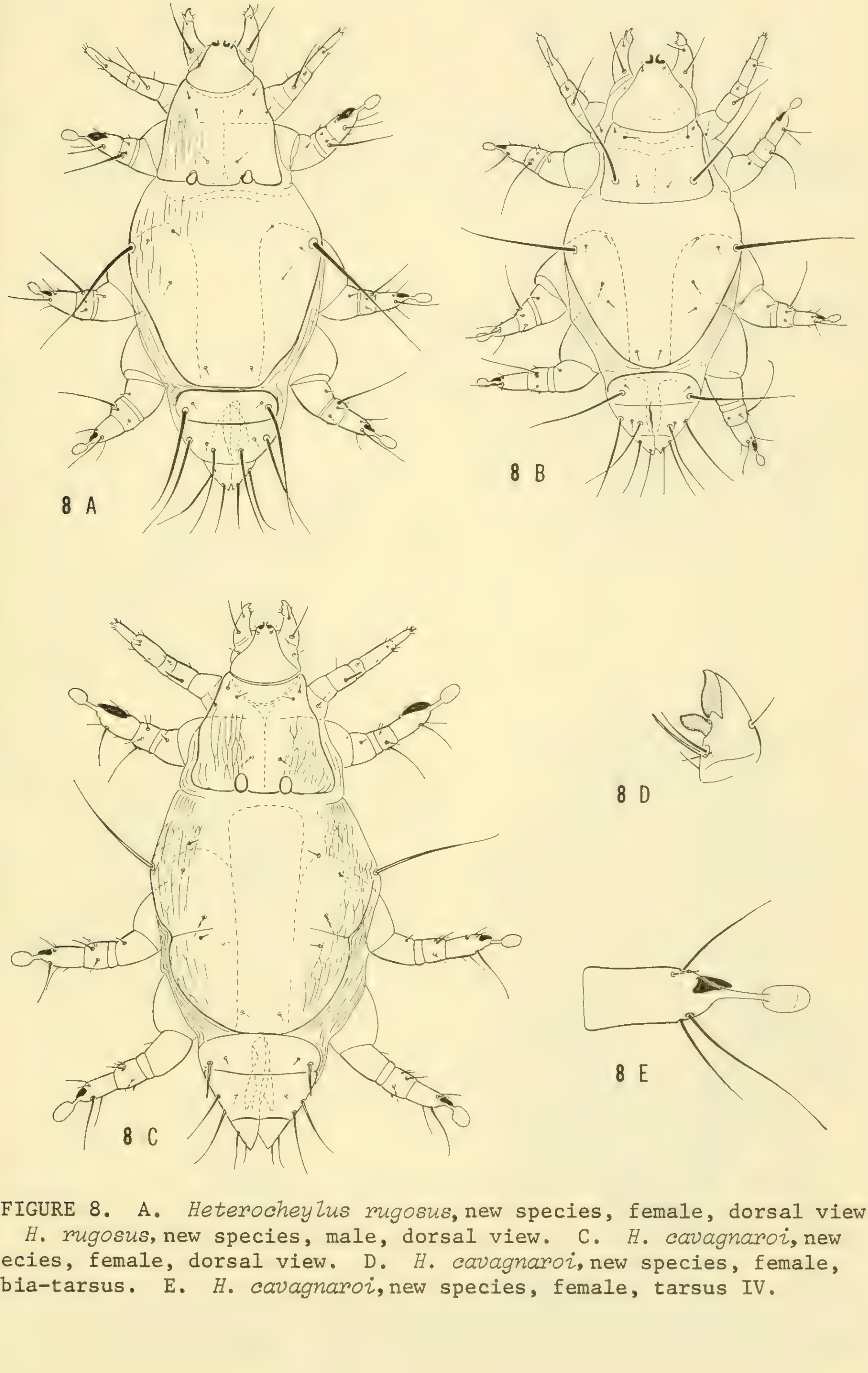

FIGURE 8. A. *Heterocheylus rugosus*, new species, female, dorsal view. B. *H. rugosus*, new species, male, dorsal view. C. *H. cavagnaroi*, new species, female, dorsal view. D. *H. cavagnaroi*, new species, female, tibia-tarsus. E. *H. cavagnaroi*, new species, female, tarsus IV.

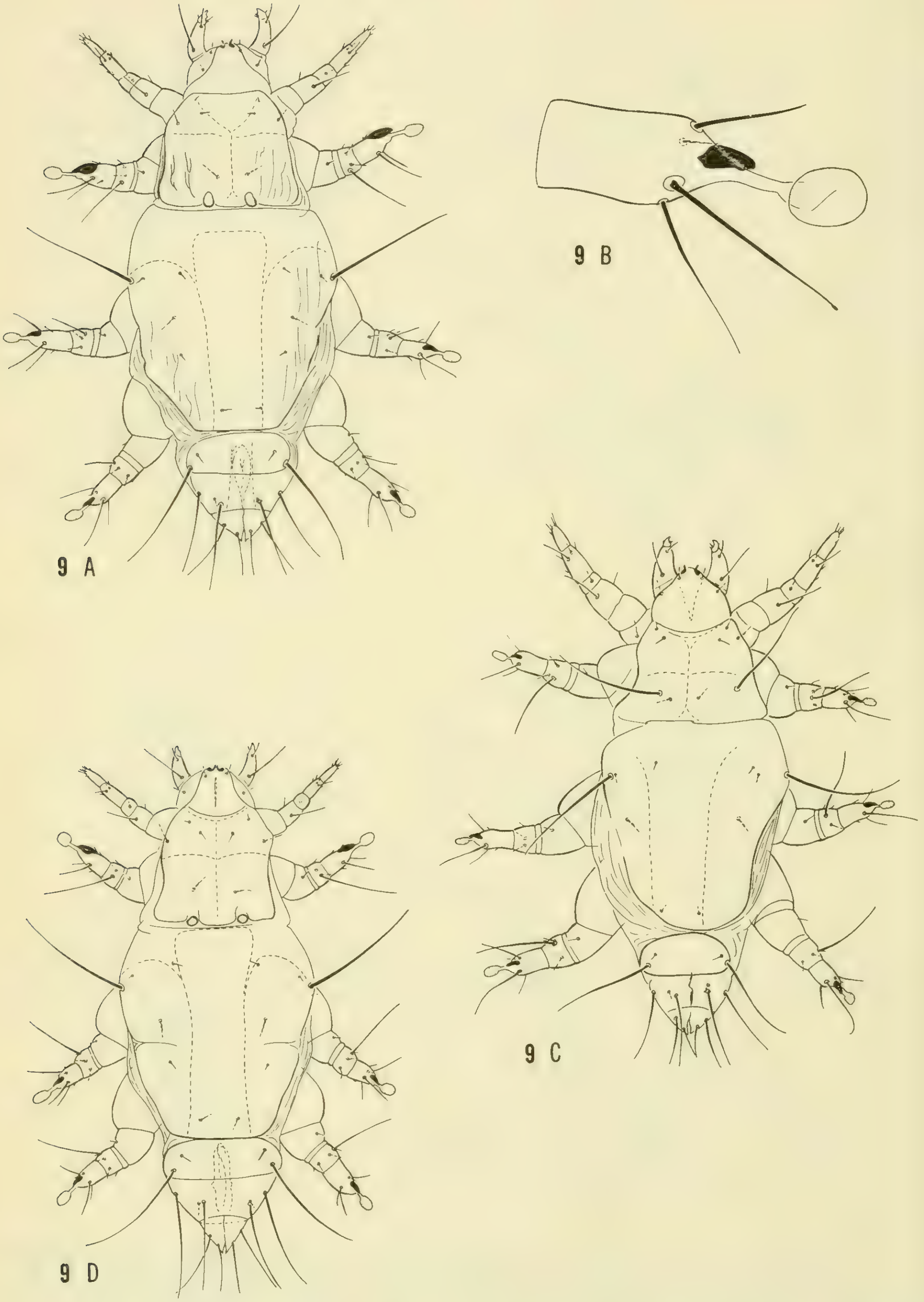

FIGURE 9. A. *Heterocheylus maai*, new species, female, dorsal view. B. *H. maai*, new species, female, tarsus IV. C. *H. maai*, new species, male, dorsal view. D. *H. parvus*, new species, female, dorsal view.

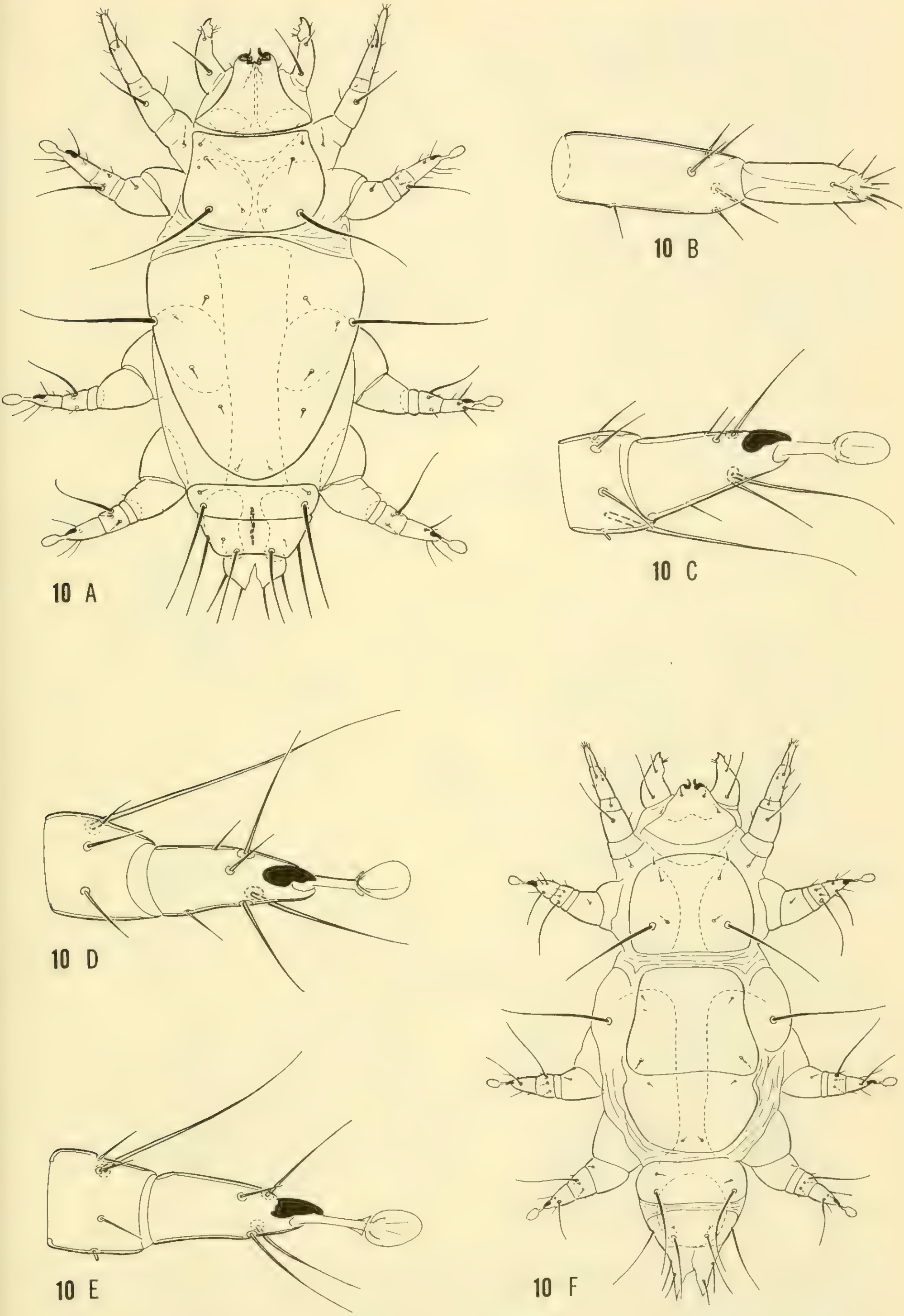

FIGURE 10. *Heterocheylus lombardinii* Womersley. A. Male, dorsal view. B. Male, leg I tibia and tarsus. C. Male, leg II tibia and tarsus. D. Male, leg III tibia and tarsus. E. Male, leg IV tibia and tarsus. F. Deutonymph, dorsal view.

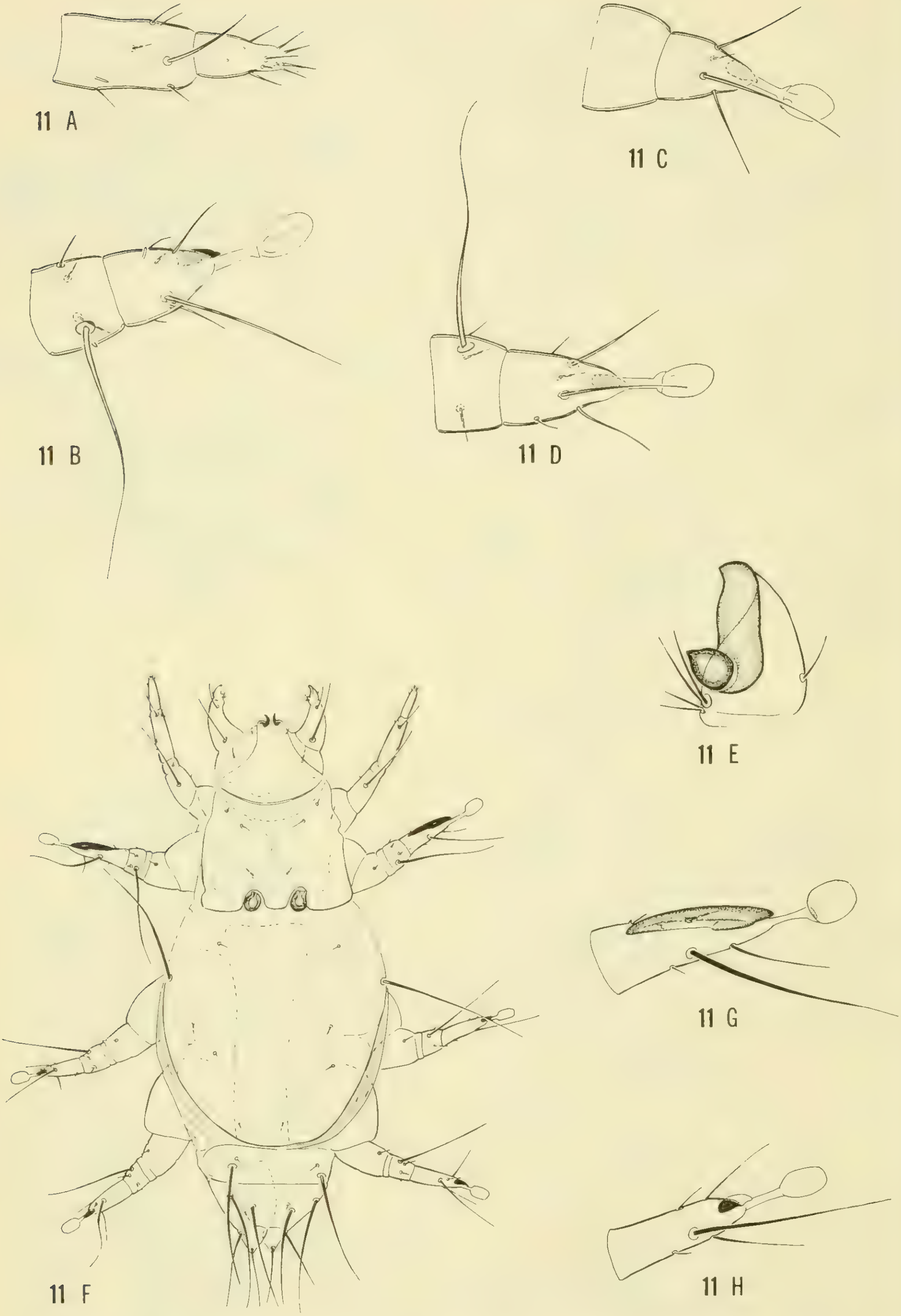

FIGURE 11. A. *Heterocheylus lombardinii* Womersley, protonymph, leg I tibia and tarsus. B. *H. lombardinii* Womersley, protonymph, leg II tibia and tarsus. C. *H. lombardinii* Womersley, protonymph, leg IV tibia and tarsus. D. *H. lombardinii* Womersley, protonymph, leg III tibia and tarsus. E. *H. nixus*, new species, female, tibia-tarsus. F. *H. nixus*, new species, female, dorsal view. G. *H. nixus*, new species, female, tarsus II. H. *H. nixus*, new species, female, tarsus III.

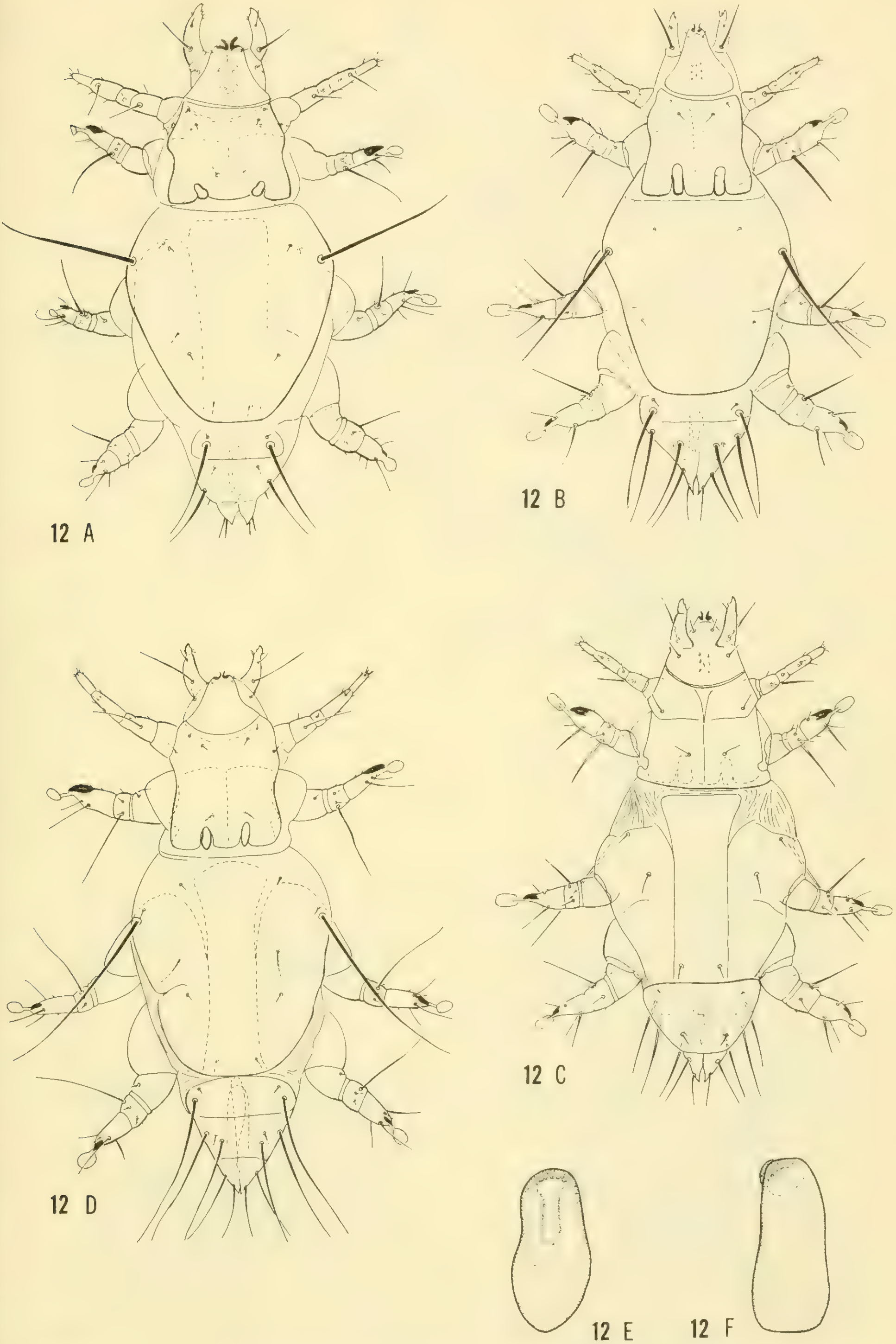

FIGURE 12. A. *Heterocheylus incohatus*, new species, female, dorsal view. B. *H. becki*, new species, female, dorsal view. C. *H. becki*, new species, female, ventral view. D. *H. novellus*, new species, female, dorsal view. E. *H. novellus*, new species, female, ampulliform organ. F. *H. becki*, new species, female, ampulliform organ.

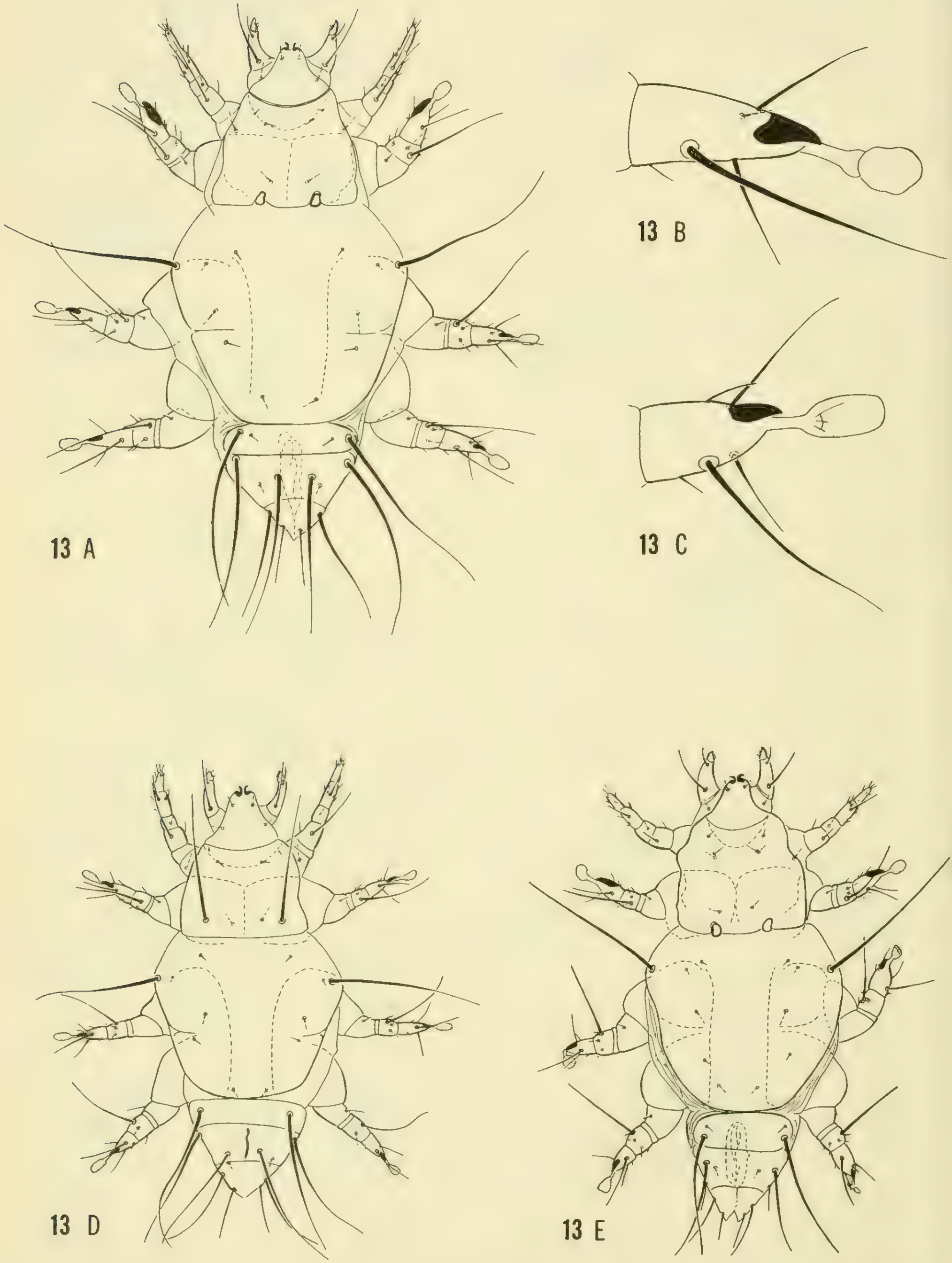

FIGURE 13. A. *Heterocheylus laui*, new species, female, dorsal view. B. *H. laui*, new species, female, tarsus IV. C. *H. minus*, new species, female, tarsus IV. D. *H. laui*, new species, male, dorsal view. E. *H. minus*, new species, female, dorsal view.

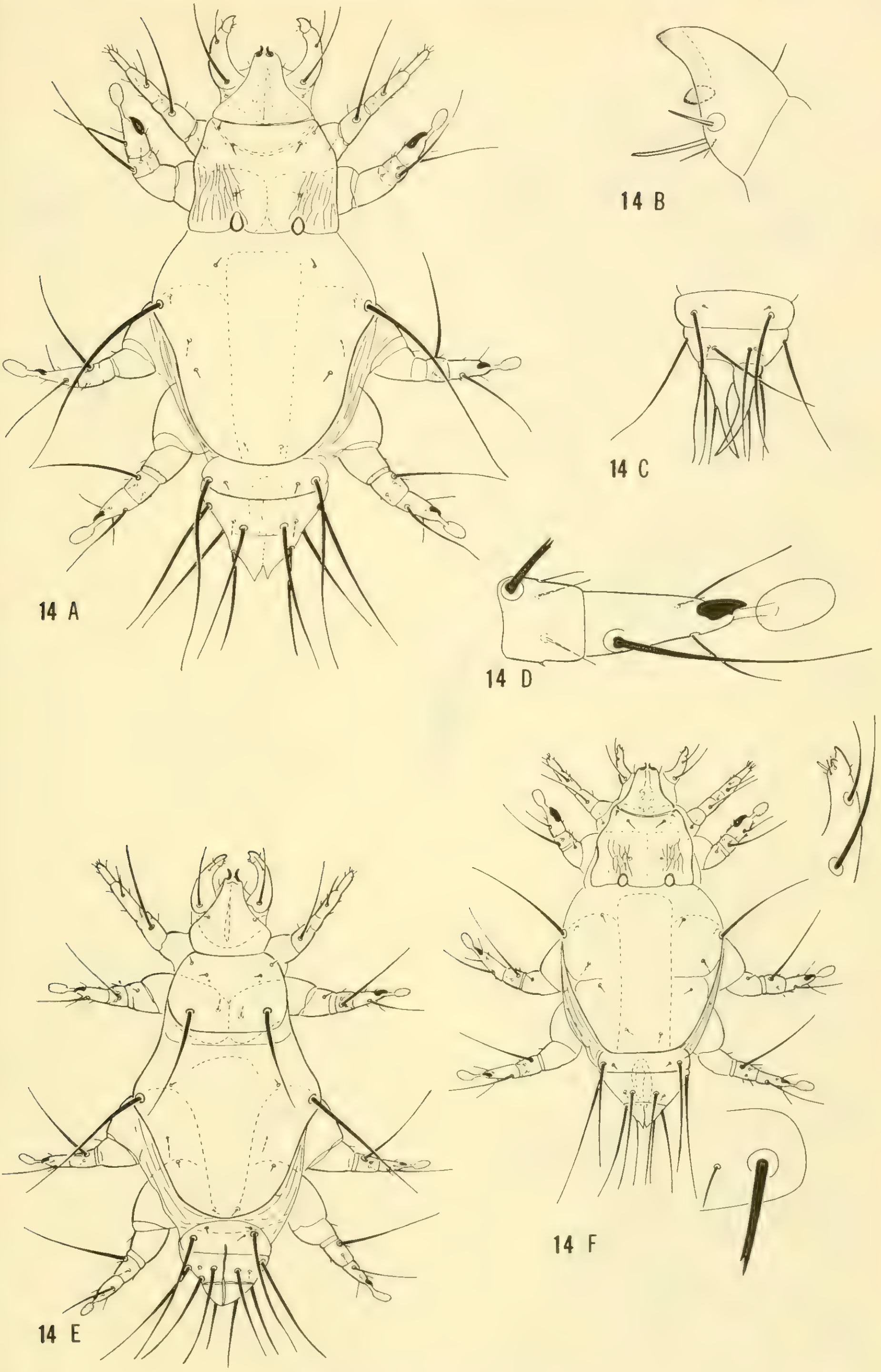

FIGURE 14. A. *Heterocheylus keiferi,* new species, female, dorsal view. B. *H. keiferi,* new species, female, tibia-tarsus. C. *H. keiferi,* new species, deutonymph, opisthosoma. D. *H. transversus,* new species, female, tarsus IV. E. *H. keiferi,* new species, male, dorsal view. F. *H. transversus,* new species, female, dorsal view.

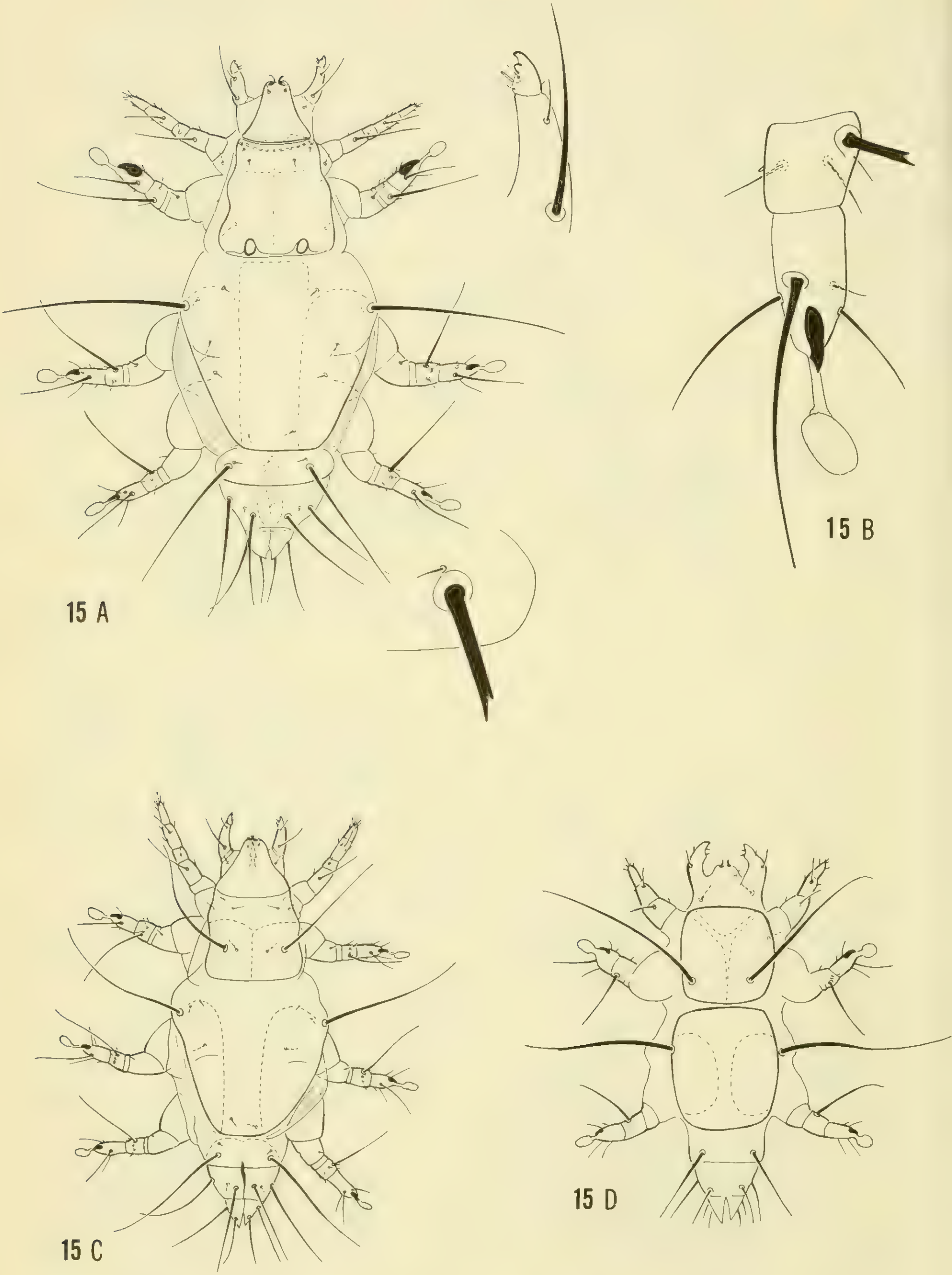

FIGURE 15. *Heterocheylus proximus*, new species. A. Female, dorsal view. B. Female, tarsus IV. C. Male, dorsal view. D. Larva, dorsal view.

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